"A COMPREHENSIVE STUDY ON COMPLICATIONS OF LAPAROSCOPIC INGUINAL HERNIA REPAIR"

A DISSERTATION SUBMITTED TO

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

In partial fulfillment of the regulations for the award of the degree of

MASTER OF SURGERY (GENERAL SURGERY)

BRANCH I: M.S (General Surgery)

DEPARTMENT OF GENERAL SURGERY

GOVERNMENT STANLEY MEDICAL COLLEGE AND HOSPITAL

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

CHENNAI

APRIL 2015

CERTIFICATE

This is to certify that the dissertation titled **"A COMPREHENSIVE STUDY ON COMPLICATIONS OF LAPAROSCOPIC INGUINAL HERNIA REPAIR "** is the bonafide work done by **DR.KRISHNABHARATH.S** Post Graduate student (2012 – 2015) in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under my direct guidance and supervision, in partial fulfillment of the regulations of The Tamilnadu Dr. M.G.R. Medical University, Chennai for M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2015.

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DECLARATION

I, **DR.KRISHNABHARATH.S** solemnly declare that this dissertation titled "**A COMPREHENSIVE STUDY ON COMPLICATIONS OF LAPAROSCOPIC INGUINAL HERNIA REPAIR"** is a bonafide work done by me in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under the guidance and supervision of my unit chief.

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This dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the university regulations for the award of M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2015.

Place: Chennai.

Date: September 2014 DR.KRISHNABHARATH.S

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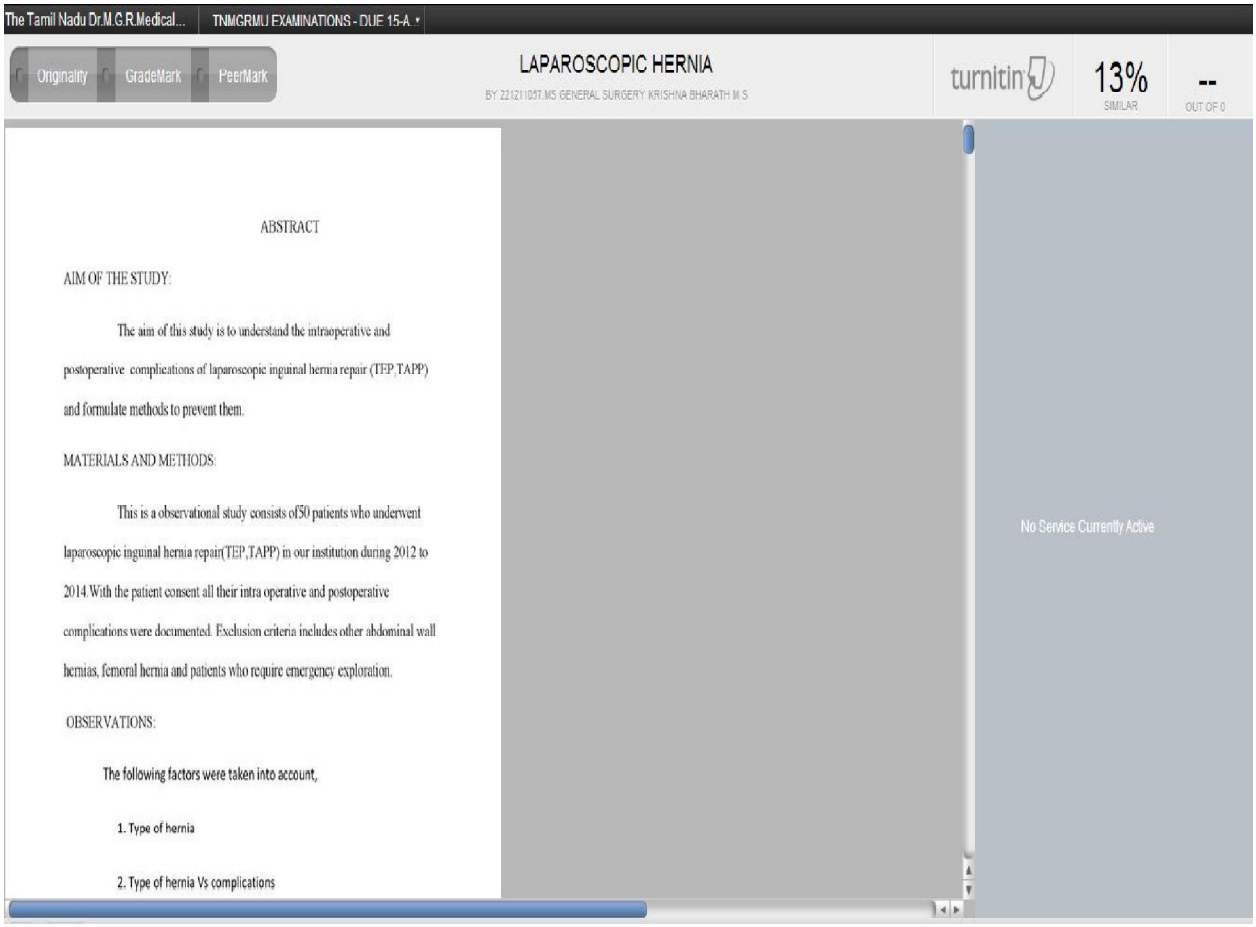
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ABSTRACT
AIM OF THE STUDY:
The aim of this study is to understand the intraoperative and postoperative complications of laparoscopic inguinal hernia repair (TEP,TAPP) and formulate methods to prevent them.
MATERIALS AND METHODS:
This is a observational study consists of50 patients who underwent laparoscopic inguinal hernia repair(TEP,TAPP) in our institution during 2012 to 2014.With the patient consent all their intra operative and postoperative complications were documented. Exclusion criteria includes other abdominal wall hernias, femoral hernia and patients who require emergency exploration.
OBSERVATIONS:
The following factors were taken into account,
1. Type of hernia
2. Type of hernia Vs complications
No Service Currently Active

INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : A comprehensive study of complications in laparoscopic inguinal hernia repair

Principal Investigator : Dr.S.Krishna Bharath

Designation : PG in MS (Gen.Sur)

Department : Department of General Surgery
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Chennai-10

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 10.01.2014 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

25/3/14

MEMBER SECRETARY,
IEC, SMC, CHENNAI

ABSTRACT

AIM OF THE STUDY:

The aim of this study is to understand the intraoperative and postoperative complications of laparoscopic inguinal hernia repair (TEP,TAPP) and formulate methods to prevent them.

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This is a observational study consists of50 patients who underwent laparoscopic inguinal hernia repair(TEP,TAPP) in our institution during 2012 to 2014.With the patient consent all their intra operative and postoperative complications were documented. Exclusion criteria includes other abdominal wall hernias, femoral hernia and patients who require emergency exploration.

OBSERVATIONS:

The following factors were taken into account,

1. Type of hernia

2. Type of hernia Vs complications

3. Operation time.

4. Operation time Vs complications.

5. Postoperative hospital stay.

Our observations were,

- ✓ Overall 50 patients were operated-5 u/l direct,29 u/l indirect, 7 b/l direct and 7b/l indirect.
- ✓ All were operated under general anesthesia.
- ✓ The mean operative time was 66.8 minutes
- ✓ There was no major complications
- ✓ Minor complications rate were 46% (23 patients)
- ✓ There was 4 minor complications namely, 1.surgical emphysema 2.groin pain, 3.shoulder pain, 4.scrotal edema
- ✓ Surgical emphysema(21patients,42%) depends upon operation time
- ✓ Groin pain(11 patients-22% all are indirect) depends upon type of hernia mainly in indirect type, because of the dissection carried out for seperating indirect sac.

- ✓ Shoulder pain (6 patients-12%) is directly proportional to the time of surgery (all were >90 minutes)probably due to retention of CO2 which lead to diaphragmatic intervention.
- ✓ Scrotal edema(6 patients-12%) depends upon the type of hernia as it occurred only in indirect hernias due to the dissection for indirect sac
- ✓ All these minor complications were subsided with supportive care without any surgical intervention.
- ✓ Mean operation time in our study is 66.8 minutes.
- ✓ Mean Post operative hospital stay- 2.6 days.
- ✓ Laparoscopic hernia repair has a steep learning curve and time consuming in its initial phase but in later stage it can be done with shorter duration without any complications and with early postoperative recovery.
- ✓ Laparoscopic inguinal hernia repair also has the advantage of identifying contralateral and occult hernias .

CONCLUSION:

Laparoscopic hernia repair has a steep learning curve and fearsome complications but once mastered , it is the safest and efficacious technique with reduced operative time and early postoperative recovery. .In our study (TEP) we encountered only minor complications all those complications were managed conservatively.

INTRODUCTION

Hernios means budding in greek. Earliest written records dealing with inguinal hernia dates back to 1500 b.c . After so many ups and downs by the first decade of the 19th century, giants such as Astley cooper ,Franz hesselbach and Antonio scarpa facilitated the development of modern hernia repairs.later Ger and his colleagues revolutionized the concept of open repair into so called laparoscopic repair.

Of all abdominal hernias 75% occur in inguinal region.

Groin hernias can be performed conventionally i.e open repair or by laparoscopically

Laparoscopic inguinal herniorrhaphy is technically more challenging than tension free repair,thus has a long learning curve but it underwent numerous modifications after its invention like Trans abdominal pre peritoneal repair(TAPP) Trans extra peritoneal repair(TEP) but these revolutionary concepts did not drastically reduce the complications.

This study will pave the way for understanding and prevent those laporoscopi complications both intraoperatively and post operatively .

OBJECTIVES

To understand the complications of laproscopic inguinal hernia repair both intraoperatively and postoperatively.

#To know the limitations of laproscopic inguinal hernia repair

#To formulate the methods to prevent the complications of laproscopic hernia repair

REVIEW OF LITERATURE

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The earliest written records dealing with inguinal hernias date back to approximately 1500 bc Early operations involved ligation of the sac and cord at the level of the external ring with excision of the sac, cord, and testis. Notable figures such as Herophilus, Erasistratus, Heliodorus and Galen, influenced by Hippocrates, “the father of medicine,” and Aristotle, “the philosopher,” performed and wrote about hernia surgery

.

The Renaissance (15th through mid-17th centuries) heralded many improvements for society, and surgery was no exception. Ambroise Pare is considered by many to be the father of modern surgery. The use of anesthesia was reinstated for inguinal hernia surgery, and preserving the testicle became an essential part of the operation as described by Casper Stromayr in 1559. The 18th

century surgeon/anatomists were the first to publish treatises with illustrations based on detailed anatomic dissections. Sir Percivall Pott's refuted the older theories concerning the cause of hernias and methods of treatment. While being the first to describe congenital hernias, he also gave a classical description of the operative repair of some the complicated hernias. Richter, a German surgeon, described the partial enterocele strangulation. A French contemporary, Alexis Littre, described herniation of a Meckel diverticulum. Jean Louis Petit recommended surgical repair of strangulated hernias only and described an external herniotomy without entering the sac, an operation that is eponymously linked to him. He also described the inferior lumbar triangle formed by the latissimus dorsi muscle, external oblique muscle, and iliac crest. It was John Hunter who renamed the lacunar ligament as Gimbernat's ligament after the Spanish anatomist described his technique of incision of the lacunar ligament for reduction of femoral hernia contents. Camper, a physician and philosopher, was the first to describe the processus vaginalis and the superficial fascia laying over the subcutaneous tissue.

By the first decade of the 19th century, giants such as Astley Cooper, Franz Hesselbach, and Antonio Scarpa produced high-quality anatomy atlases that facilitated the development of modern hernia repairs. Marcy, an American surgeon and pupil of Lister, was the first to recognize the importance of the transversalis

fascia and closing the internal ring when repairing an inguinal hernia. Furthermore, he emphasized the need for antisepsis. Edoardo Bassini, another pupil of Lister, described his technique of dissecting and ligating the sac high in the retroperitoneal space after dividing the transversalis fascia and emphasized the importance of including the transversalis fascia in his posterior wall buttress, which involved suturing the internal oblique and transversus abdominis with the upper layer of the transversalis fascia in one layer (Bassini's famous triple layer!) to the lower leaf of the transversalis fascia and the inguinal ligament with interrupted silk sutures. These phenomenal results have earned him the title of Father of Modern Herniorrhaphy..

Proponents of prosthetic material began to express the opinion that these materials might be the solution for achieving the holy grail of a “tension-free” repair as early as the 1950s. However,Modern hernia specialists such as Lichtenstein in 1986 and Gilbert in 1987 reported their techniques of “tensionless and sutureless” repairs, which involved placing a synthetic polypropylene mesh either deep to or in front of the repaired transversalis fascia in addition to using a rolled-up strip of mesh to plug wide hernial defects.

The preperitoneal space can also be used to repair an inguinal hernia. The basis of preperitoneal repairs is to reinforce the space between these so called

fascioperitoneal layers, thereby re-establishing this ability of this transversalis fascia to retain intra-abdominal viscera.Read and Rives favor an anterior approach through a conventional groin incision. In contrast, Nyhus, Condon, and Wantz in the United States and Stoppa and others in France have been strong proponents of an extraperitoneal posterior approach, either a midline, high transverse or Pfannenstiel incision, especially for complicated or recurrent hernias. The introduction of therapeutic laparoscopy into general surgery in the early 1990s made a transabdominal approach to the same space more attractive

The procesus vaginalis is a diverticulum ofperitoneal layer in the development of wall of abdomen that crosses the inguinal canal; in males it forms the tunica vaginalis testis. In the eighth week of fetal life, the processus vaginalis is open into the inguinal canal with an extraperitoneal gubernaculm, a column of tissue mesenchymal origin that connects the fetal testis and the scrotal axis and plays a role in testicular descent. The primitive testis and metanephros lie close together near the pelvic brim. As the trunk of the fetus elongates, the kidney migrates upward and the testis follows its anchoring gubernaculum downward. By the third trimester, it is located behind the processus vaginalis. At birth, 60% of infants still have an open processus. This figure drops by half after the first month. Although a persistent processus vaginalis is associated with an indirect inguinal hernia, it is important to realize that the processus vaginalis remains open in 25% of adult men, in most of whom an inguinal hernia never develops.A persistent processus vaginalis in females is known as the canal of Nuck.

ETIOLOGY, BIOCHEMICAL BASIS, AND MECHANICAL STRESS

The cause of an inguinal hernia is undoubtedly multifactorial. From the development of human race from apes, the wall of abdomen does not have any protection at all. Excessive strain of an individual does not matters as an important factor as believed because sprinters, runners do not have an higher incidence of

inguinal hernias. Russel proposed the so-called saccular theory based on the presence of a patent procesus vaginalis as the cause of an inguinal hernia indirect in origin. Increased intra-abdominal pressure and relative weakness of the posterior inguinal wall are thought to be important in the development of direct inguinal hernias.. Fruchaud's concept states that the basic concept of inguinal hernias is due to failure of these fascioperitoneal reflections.

Familial predisposition and the role of connective tissue diseases in hernia development have received considerable attention in recent years. Various connective tissue disorders, such as osteogenesis imperfecta, Marfan's syndrome, Ehlers-Danlos syndrome, and congenital dislocation of hip, are associated with hernias.

Recent studies dealing with the development of a hernia have focused on the ECM. The Extracellular matrix is maintained by the family of matrix metalloproteinases as there is a constant balance between its production and its destruction.recent trials also concluded that overexopression of these proteinases in the fibroplasts which are present in the groin region especially in the recurrent hernias

ANATOMY

A surgeon who is attempting to repair a hernia with an open technique as opposed to one using a laparoscopic approach views the abdominal wall anatomy differently. The abdominal wall spans the space between the lower ribs and the pelvis.

Anterior Abdominal Wall

The lines of langer which runs parallel in the skin run horizontally around the trunk, and this is clinically important when planning operative incisions. Camper's fascia is the superficial fatty layer that lies below the skin; it is continuous below with the outer layers of fascia covering the perineum and genitalia and also contains the dartos muscle fibers of the scrotum.A second fascial layer in the superficial abdominal wall is the deep fascia of Scarpa, which is composed of compressed fibrous components of the superficial fascia Scarpa's fascia also fuses with the deep fascia investing the external oblique muscle. This fascia is bound inferiorly to the inguinal ligament and pubis before continuing onto the thigh, where it blends with the fascia lata to seal the space beneath and inferior to the inguinal ligament, which is the inferior portion of the myopectineal orifice. This portion of the inguinal region includes Hesselbach's triangle superiorly and is therefore the weakest aspect of the groin.

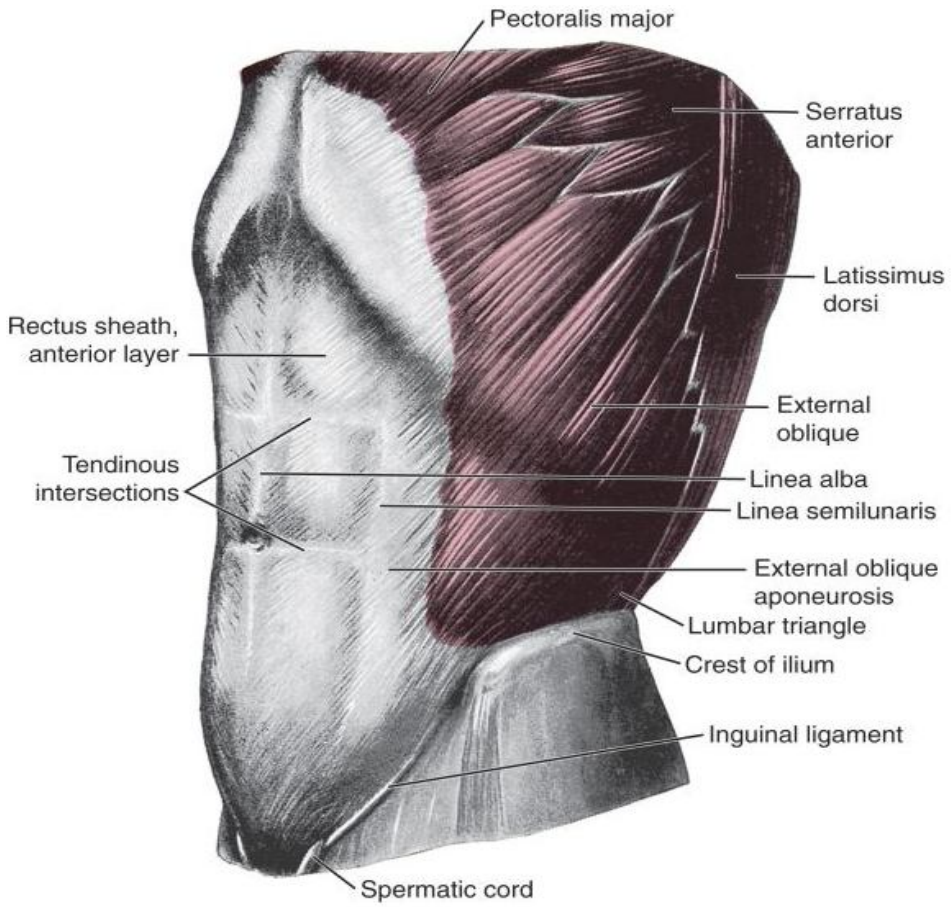


Figure 45-2 Left anterolateral view of the abdominal wall muscles showing the anterior rectus and external oblique muscles.

External Oblique Muscle and Associated Ligaments

The external oblique arises from the posterior aspect of the lower eight ribs. The direction of the muscle fibers varies from nearly horizontal in its upper portion to oblique in the middle and lower portions. The fibers fan out and insert into the xiphoid process, linea alba, pubic crest, pubic tubercle, and anterior half of the iliac crest. The obliquely arranged anteroinferior fibers of insertion fold on themselves to form the inguinal ligament.

The inguinal ligament is important because of its role as both a landmark and an integral component of many groin hernia repairs. It is the incurved free edge of the external oblique aponeurosis between its origin on the iliac crest and its insertion at the pubis. The ligament has a caudally directed convexity as a consequence of its connection to the fascia lata of the thigh. The ligament bridges the muscular and vascular structures that leave the pelvis inferiorly. This area deep to and above the inguinal ligament, including Hasselbach's triangle (see later), is called the *myopectineal orifice.* At its insertion to the pubic tubercle, the fibers of the inguinal ligament flare out in a fan-like fashion and fuse with the anterior rectus sheath and fibers from the opposite inguinal ligament along the upper border of the pubic bone to form the superior pubic ligament. The inguinal ligament continues downward to the superior pubic ramus to form the lacunar (Gimbernat's) ligament and courses laterally along the pectineal line as Cooper's ligamet

Laparoscopic Anatomical description of the Inguinal Region

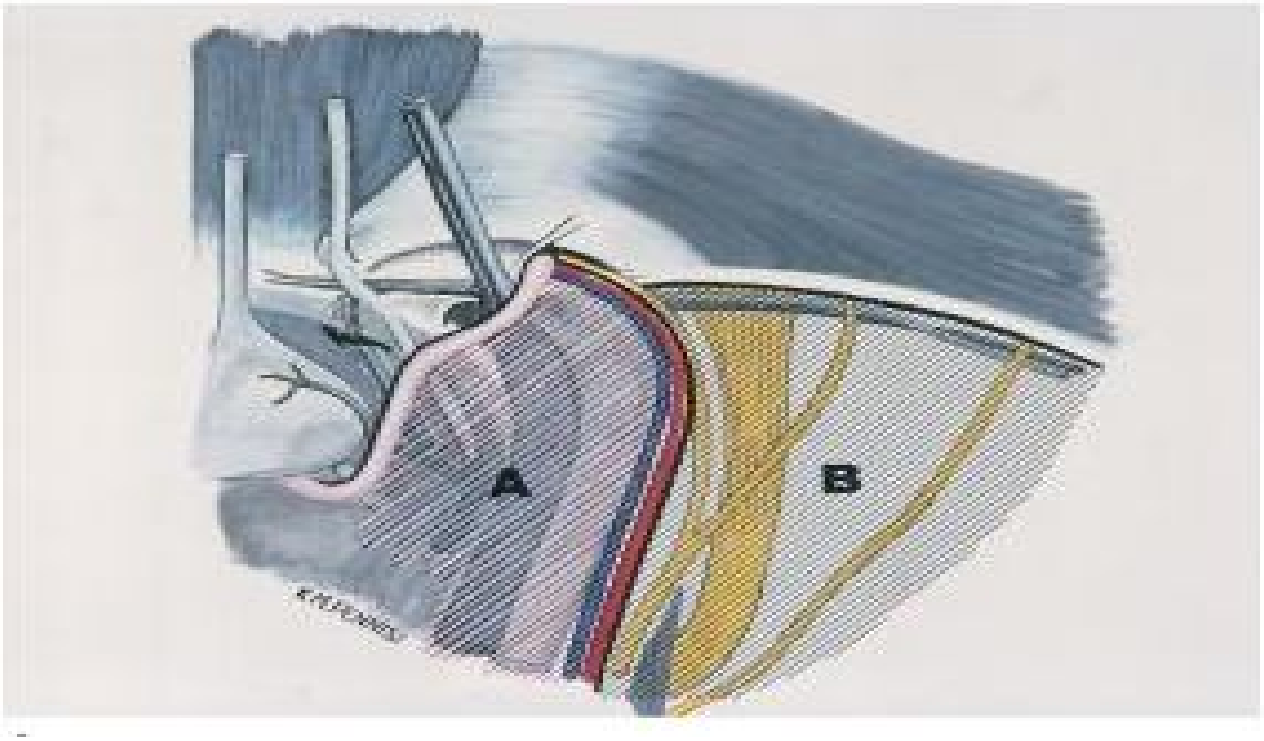
Deep Aspects of the Anterior Abdominal Wall, Peritoneal Folds, and Associated Structures

Distending the peritoneal cavity with gas allows identification of the umbilical peritoneal folds, which are prominent and easily identifiable landmarks in most individuals. The single median umbilical fold extends from the umbilicus

to the urinary bladder and covers the fibrous remnant of the allantois, the urachus. The medial umbilical fold, on either side, is formed by the underlying obliterated portion of the fetal umbilical artery, a branch of the internal iliac artery divides anteriorly. The patent proximal portion of this artery supplies the superior vesical artery to the bladder. The lateral umbilical fold covers the inferior epigastric arteries as they course toward the posterior rectus sheath, which they enter approximately at the level of the arcuate line. The *supravesical fossa* is the depression found between the medial and median umbilical ligaments. This is also the site for hernias of the same name. The *medial fossa* is the space between the medial and lateral ligaments and is the site of direct inguinal hernias. The *lateral fossa* is less well delineated than the others. The lateral umbilical ligament and the rectus abdominis form the medial border of the fossa. This fossa does not have a lateral border; rather, the concavity slowly attenuates and is the site of congenital or indirect inguinal hernias.

Injury of nerve during laparoscopic hernia repair may cause considerable and often persistent postoperative pain. The iliohypogastric, ilioinguinal, genitofemoral, lateral femoral cutaneous, and femoral nerves are all at risk. Two anatomic danger zones in regard to nerve and vessel injury are described and must be avoided. The first danger zone is the so-called *triangle of doom,* which is an area bordered laterally by gonadal vessels and medially by the vas deferens with

its apex orientated superiorly at the internal ring. The inferior border is arbitrary because it is the interface between dissected and nondissected peritoneum after preperitoneal dissection . Within this triangle are the external iliac vessels, the deep circumflex iliac vein, the genital branch of the genitofemoral nerve, and the femoral nerve. The second anatomic danger zone is referred to as the *triangle of pain* or the *electrical hazard zone.* The medial border is constant and is formed by the internal spermatic vessels. It is questionably accurate to call this zone a triangle inasmuch as the lateral and inferior borders are nebulous because the entire space lateral to the internal spermatic vessels where critical nerves pass is included. The "triangle" contains the lateral femoral cutaneous nerve, the femoral branch of the genitofemoral nerve, and the femoral nerve. Avoidance of electrosurgical energy, dissection, or the application of staples within these triangles is crucial to prevent nerve injury, entrapment, or vascular injury. The genitofemoral nerve is especially at risk during laparoscopic herniorrhaphy, as is the lateral femoral cutaneous nerve.



Transversalis Fascia and Its Derivatives

Harrison in 1922 was the first to stress the importance of the fascia transversalis in the pathology and repair of inguinal hernias. The transversalis fascia is a layer which continous and spreads in extraperitoneal region ,it covers illiopsoas muscles and transverse abdominis and few region of the periosteum.

There is a posterior fatty preperitoneal component (referred to as the preperitoneal fascia by some) and an anterior lamina that is adherent to the deep surface of the transversus and rectus abdominis muscles. The transversalis fascia is essentially a vascular envelope that encloses between these two laminae the arterial and venous plexuses that supply the muscles of this region. The extraperitoneal

space of Bogros lies behind the posterior lamina. It is important that in any preperitoneal approach the prosthesis be placed deep to the posterior lamina of the transversalis fascia, but superficial to the vas deferens and the parietalized spermatic vessels lying in the extraperitoneal fat.

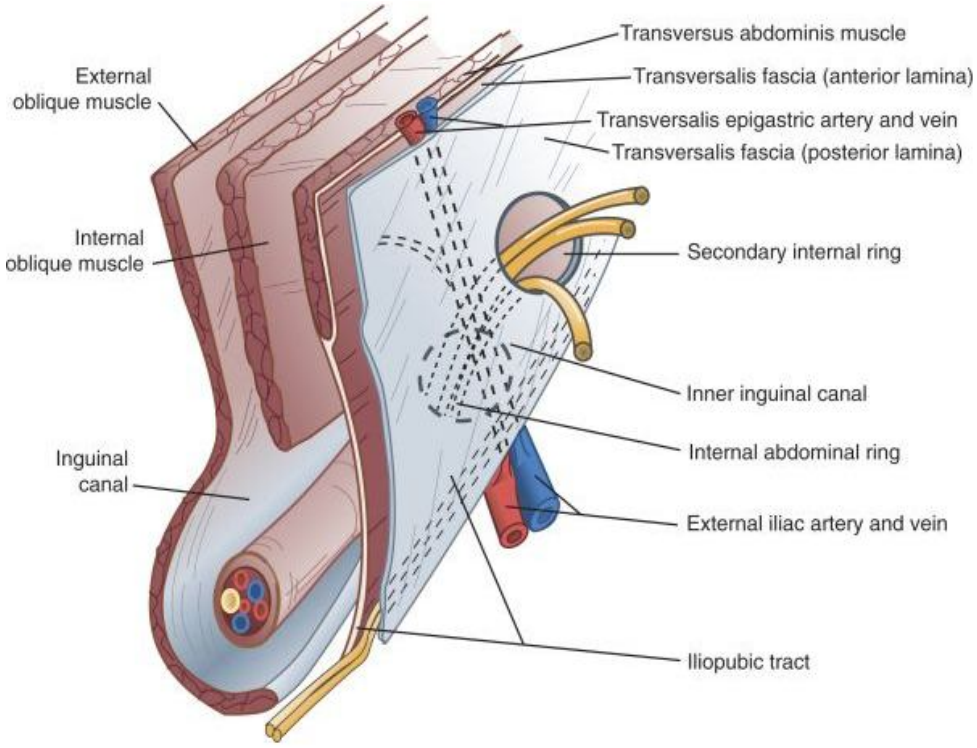


Figure 45-8 Parasagittal view of the right midinguinal area demonstrating the two laminae of the transversalis fascia.

At its attachments to the pubis and at points where it is penetrated by neurovascular or cord structures the transversalis fascia thickens to form important derivatives: the arch of illeopectineum, the iliopubic tract, and the inner inguinal ring both crura. The superior and inferior crura form a sling around the deep inguinal ring, a structure shaped like a “monk's hood.” When the transversus abdominis contracts, the crura of thedeep ring which is pulled lateral and upwards,

which results in a valvular action that helps prevent the formation of an indirect hernia. With the increasing use of laparoscopy the iliopubic tract has become a more important surgical landmark. It is the thickened band of transversalis fascia formed at the zone of transition between the deep surfaces of the iliac and transversus abdominis muscles.

Hesselbach's Triangle and the Spermatic Cord

The inguinal (Hesselbach's) triangle is formed by the rectus abdominis medially, the inferior epigastric vessels superolaterally, and the inguinal ligament at the base. It is the site of herniation ofdirect inguinal hernia. Only the peritoneum and transversalis fascia cover the triangle in this area. The aponeurotic arch, which is formed from the transversus abdominis muscle, crosses the apex of this triangle and reinforces this area of weakness when one strains. A high arch may predispose to the formation of direct inguinal hernias by offering less reinforcement. The cord structures include the ductus deferens, the pampiniform venous plexus, the testicular artery, and the genital branch of the genitofemoral nerve, a branch of the lumbar plexus.

Innervation and Blood Supply of the Abdominal Wall

The lumbar plexus is formed in the psoas muscle from the anterior rami of the upper four lumbar nerves. The branches of the plexus emerge from the lateral and medial borders of the muscle and its anterior surface. The iliohypogastric, ilioinguinal, lateral cutaneous nerve of the thigh, and femoral nerves emerge from the lateral border of the psoas, in that order from above downward. The genitofemoral nerve is the most anterior of the nerves encountered. The genital branch travels with the spermatic cord and ultimately innervates the cremaster muscle and the lateral aspect of the scrotum. Most studies show that the branches of the lumbar plexus destined for the thigh run beneath the iliopubic tract, which has important implications for a surgeon working in the preperitoneal space. This is not universally accepted, however, because anomalous routes for some of the nerves above the iliopubic tract have been described. The genitofemoral nerve from which femoral branch innervates the proximal midthigh skin. The iliohypogastric and ilioinguinal nerves (L1) enter the lateral and anterior abdominal walls. The iliohypogastric nerve crosses the iliac fossa just inferior to the kidney and pierces the transversus abdominis. The subsequent course of the nerve carries it between the transversus and the internal oblique until it pierces the aponeurosis of both obliques just above the external inguinal ring. The ilioinguinal nerve normally crosses the iliac fossa just inferior to the iliohypogastric nerve. The nerve pierces the transversus and internal oblique above the iliac crest and

subsequently enters the inguinal canal. The iliohypogastric nerve supplies the skin of the lower part of the anterior abdominal wall, and the ilioinguinal nerve passes through the inguinal canal to supply the skin of the groin and the scrotum or labium majus. The lateral cutaneous nerve crosses the iliac fossa under the iliac fascia and pierces the inguinal ligament to enter the thigh. The femoral nerve lies immediately below the lateral aspect of the psoas muscle and is not routinely encountered in laparoscopic surgery, although there are some reports of injury to this nerve.

The primary blood supply to the deep anterior abdominal wall is from the inferior epigastric artery, a tributary of the external iliac artery. Aberrant obturator vessels may arise from the inferior epigastric vessels, arch inferiorly over Cooper's ligament, and join the normal obturator circulation to form the corona mortis; copious bleeding can result during careless dissection of Cooper's ligament or when one attempts to release a tight femoral hernial neck by incising the lacunar ligament. It is questionable whether the finding of a corona mortis should be considered anomalous because the variant is so common. Other veins in this area are larger than the accompanying arteries and are also prone to injury. The external iliac artery and vein are the vessels in the vascular compartment of the deep inguinal region. The deep circumflex iliac artery and vein pierce the transversalis fascia and run along the iliac fossa to anastomose with the deep lumbar system. As

they course along the iliopubic tract, they can be inadvertently stapled or otherwise injured during laparoscopic herniorrhaphy.

Laparoscopic Inguinal Hernia Repair

Laparoscopic techniques and procedures were introduced into mainstream general surgery in the 1980s with the development of laparoscopic cholecystectomy. Since then, the laparoscopic approach has been adapted for numerous conventional general surgical operations, and many ingenious surgeons have devised new operations using videoscopic principles. Inguinal hernia surgery is no exception. The two most commonly performed laparoscopic inguinal hernia repairs, the *transabdominal preperitoneal* (TAPP) repair and the *totally extraperitoneal* (TEP) repair, have been modeled after the conventional open preperitoneal inguinal hernia repairs. The *intraperitoneal onlay mesh* (IPOM) repair, however, is a novel laparoscopic approach and is the only truly minimally invasive laparoscopic herniorrhaphy because radical dissection of the preperitoneal space is avoided. .

APPLIED ANATOMY OF THE REGION

A detailed understanding of the anatomy of the deep inguinal region and the posterior aspect of the anterior abdominal wall is necessary to perform a

laparoscopic inguinal hernia repair. Mastery of this knowledge is especially important because the region contains a number of major blood vessels and nerves that may be exposed to injury..

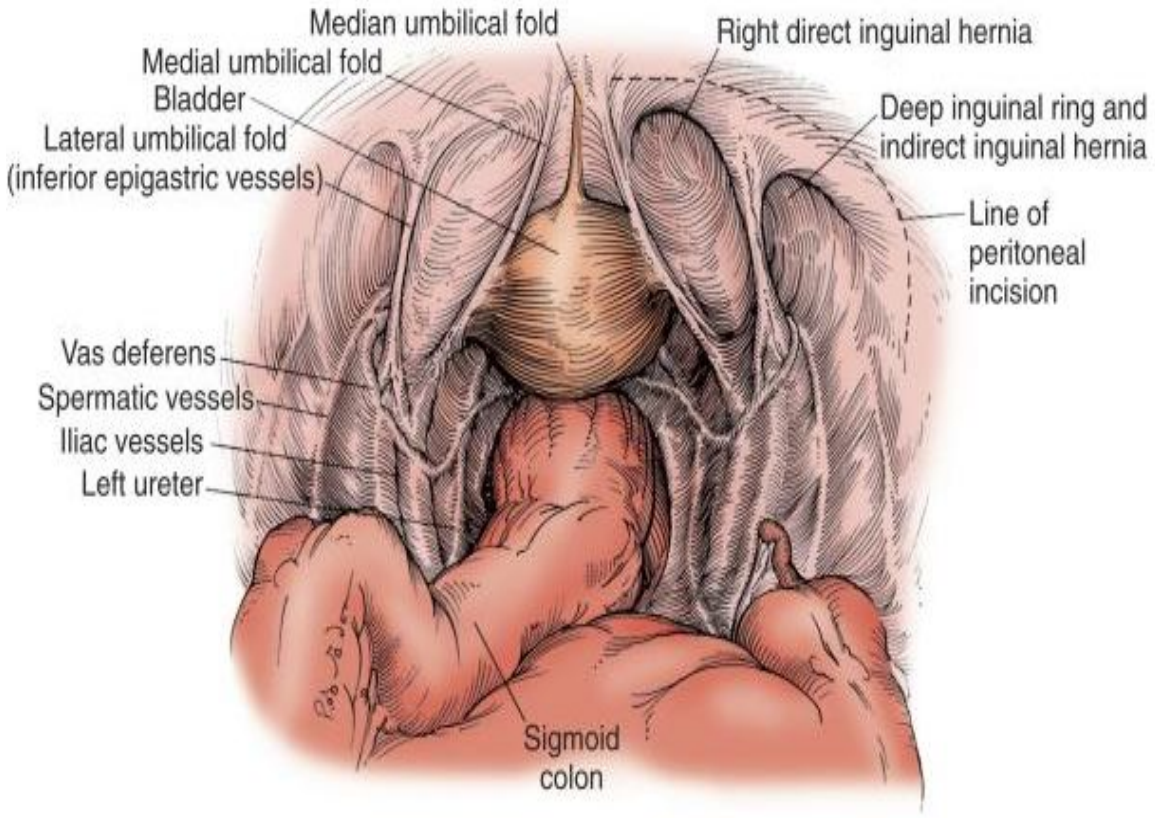


Figure 46-1 Laparoscopic view of groin anatomy before incision of the peritoneum.

Peritoneal Folds and Fascia Transversalis

The umbilical folds in most patients are quite prominent and easily identified. They have been referred to as ligaments in some texts but do not possess the true structure of a ligament. The unpaired median umbilical fold covers the urachus, the

fibrous remnant of the fetal allantois, and extends from the urinary bladder to the umbilicus. The urachus may be patent for a variable length along its course, usually close to the urinary bladder in adults and close to the umbilicus in children. The paired medial umbilical folds are created by the obliterated fetal umbilical arteries. The artery, like the urachus, may be patent in its proximal course and may contribute to the superior vesical artery. The paired lateral umbilical folds are created by the peritoneal coverings over the inferior epigastric vessels. The inferior epigastric artery arises from the external iliac artery and supplies the anterior abdominal wall. It enters the rectus sheath at about the level of the arcuate line. Injury to this vessel may occur during accessory trocar placement. The fossa lying between the median and medial umbilical folds is called the supravesical fossa. The fossa formed between the medial and lateral ligaments is the medial fossa and is the site of direct inguinal hernias. The lateral fossa extends lateral to the lateral umbilical fold and is the site of indirect inguinal hernias.

The fascia transversalis is a continous layer which spreads in acontinous fashion covering the important muscles of inner wall of abdomen like illiopsoas and transverse abdominis and some regions of the periosteum of the pelvis. Some authors believe that this fascia consists of two layers or laminae. The importance of the transversalis fascia for laparoscopic hernia surgeons is due to its derivatives or

analogues: the arch of illiopectineum, iliopubic tract, and the inner inguinal ring both cruras. The iliopectineal arch, a condensation of the transversalis fascia, is situated at the medial border of the iliacus muscle and is continuous with the fascia iliaca, or the endoabdominal fascia covering the iliacus. The arch which is present in illeopectineum region divides the iliac vessels of vascular compartment from the neuromuscular compartment containing the iliopsoas muscle, femoral nerve, and lateral femoral cutaneous nerve. The iliopubic tract is a condensation of the transversalis fascia that gives lateral attachment to the crest of illeum , crosses over the femoral vessels, and inserts on the pubic tubercle medially. It serves as an important landmark for laparoscopic surgeons, and its location should always be established during preperitoneal dissection. Branches of the lumbar plexus (T12, S1-S4) are located inferior to this tract. Mesh fixation or excessive dissection in this location can lead to nerve damage/entrapment and result in long-term morbidity. The superior and inferior crura of the deep inguinal ring are derived from the transversalis fascia and form a fascial sling. When the transversus abdominis contracts, the inner ring both cruras are pulled lateral and upwards, thereby creating a valve-like action at the deep ring that prevents the formation of

indirect hernias.

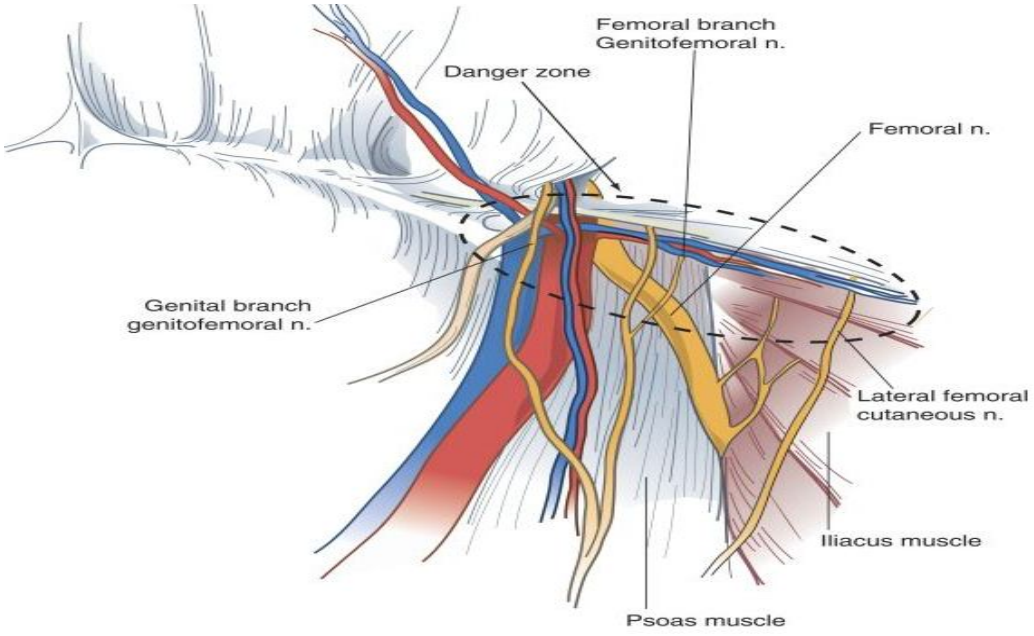


Figure 46-2 Important nerves and their relationship to inguinal structures (the right side is illustrated).

SYMPTOMS AND DIAGNOSIS

Patients with groin hernias have a wide range of clinical manifestations ranging from no symptoms at all to a life-threatening condition caused by strangulation of incarcerated intestinal contents. Asymptomatic patients are detected during routine physical examination or seek medical attention for a painless groin bulge. Indirect hernias are more likely to produce symptoms than direct ones are, with patients describing a heavy feeling or dragging sensation that tends to be worse as the day wears on.

Physical examination is the best way to determine the presence or absence of an inguinal hernia. The diagnosis may be obvious by simple inspection when a visible bulge is present. Nonvisible hernias require digital examination of the inguinal canal, which is best done in both the lying and standing positions. This invagination test helps distinguish a true hernia from a normal expansile bulge of muscle. Classic teaching is that an indirect hernia will push against the fingertip whereas a direct hernia will push against the pulp of the finger. The ring occlusion test is based on the premise that fingertip pressure over the midinguinal point will prevent an indirect hernia from protruding but will not be able to control a direct hernia.

Sliding hernias constitute about 1.5% of all inguinal hernias. One wall of the sac, the posterior and lateral, is formed by a hollow viscus, usually the cecum on the right and the sigmoid colon on the left. The bladder may be present. The danger of these hernias is that the viscus may be mistaken for a sac and opened. They occur more commonly in the elderly, especially those with longstanding herniation. Characteristically, they can be only partially reduced during physical examination. A preperitoneal approach to the groin, whether open or laparoscopic, enables easier reduction and repair of these difficult hernias.

Irreducibility and incarceration may persist for years or decades without great inconvenience as a result of adhesions developing between the contents and the sac. Recent onset of incarceration is a potentially dangerous condition because it may result in strangulation and gangrene of the contents and is an indication for urgent repair. Bowel obstruction is more common in indirect, recurrent, and femoral hernias and is of the closed loop type. As a result of blockage at both the entry and exit of the intestine at the level of the internal ring, the pressure in the intestinal lumen and accompanying vasculature and lymphatics cannot be dissipated, and perforation and gangrene of the bowel follow in neglected cases. Plain roentgenograms of the abdomen can be diagnostic. Taxis can be attempted in the absence of signs of strangulation. Taxis is performed with the patient sedated and in the head down position. The sac of hernia neck is grasped with one hand while the other applies pressure on the most distal part of the hernia. The goal is to elongate the neck of the hernia so that the contents of the hernial sac can be reduced with a rocking movement. Mere pressure on the most distal part of the hernia causes bulging of the hernia contents around the neck, which can occlude the neck and prevent reduction. Taxis should be performed only by a surgeon who is willing to observe the patient after successful reduction because of the slight possibility that gangrenous bowel might be reduced into the abdomen, viable hernia contents might be perforated, or the phenomenon known as en masse

reduction might occur, which is defined as displacement of a hernia mass without relief of incarceration or strangulation secondary to a constricting fibrous ring. Strangulation is a life-threatening condition. The irreducible hernia is tense and tender, and the overlying skin may be discolored with a reddish or bluish tinge. The patient is often febrile, dehydrated, and toxic. Laboratory investigations often reveal metabolic acidosis and leukocytosis with a left shift.

Radiologic investigations are sometimes warranted to correctly diagnose the cause of groin pain. Herniography, though invasive, helps avoid unnecessary surgical exploration. Ultrasound is useful, especially in acute manifestations of groin swelling, to distinguish incarcerated bowel from acute lymphadenitis. It is, however, operator dependent.

Cross-sectional imaging techniques such as magnetic resonance imaging (MRI) and computed axial tomography are increasingly being used for the investigation of groin pain and swelling. Hernias are visualized as anteroposterior ballooning of the inguinal canal with simultaneous protrusion of fat or bowel.

CLASSIFICATION

Surgeons have classified hernias of inguinal region as direct or indirect and groin hernias as inguinal or femoral. Although it was Cooper who devised the

concept of direct and indirect, it was Hesselbach who used the inferior epigastric vessels as the defining boundary between these two areas. With the advent of a new generation of herniorrhaphies in the 1950s there arose importance in devising a classification which isscientifically accepted for groin hernias. Harkins developed a grading system to classify groin hernias. Grade I consists of indirect infant hernias, whereas grade 2 represents simple indirect hernias in older children and healthy young adults. Grade 3 hernias are “intermediate” types of hernia (larger indirect hernias, inguinal hernias in young adults or small hernias in older patients with strong tissue, or direct inguinal hernias in older patients with strong tissue or narrow necks). Grade 4 hernias include recurrent, femoral, direct, and indirect hernias not specifically falling within the earlier grades.

The prime importance of classifying hernias are to compare them according to severity so that various treatment modalities can be achieved but with lotof surgical approaches available none of the classifications were accepted universally.

Table 45-1 -- Inguinal Hernia Classification Systems

Modified	Traditional	Nyhus-Stoppa	Modified Gilbert	Schumpelick/Aachen
IA	Indirect small	I	1	L1

Modified	Traditional	Nyhus-Stoppa	Modified Gilbert	Schumpelick/Aachen
IB	Indirect medium	II	2	L2
IC	Indirect large	IIIB	3	L3
IIA	Direct small	IIIA	5	M1
IIB	Direct medium	IIIA	—	M2
IIC	Direct large	—	4	M3
III	Combined	IIIB	6	Mc
IV	Femoral	IIIC	7	F
0	Other	—	—	—
R	Recurrent	IV A, B, C, D	—	—

SURGERY

Indications and Alternatives

Strangulation and bowel obstruction are sometimes referred to as hernia accidents and are absolute indications for surgery. Unlike an adhesive bowel

obstruction, obstruction caused by an inguinal hernia is almost never partial. Therefore, semiurgent surgery is indicated. Resuscitation includes bowel decompression, intravenous fluids to correct dehydration and electrolyte imbalance and ensure optimal urine output, followed by immediate surgery. All significantly symptomatic hernias should be repaired to improve quality of life. Nonoperative treatment is applicable only for asymptomatic and minimally symptomatic hernias. . Nonoperative treatment remains controversial, and most standard surgical texts continue to recommend surgical repair of all inguinal hernias at diagnosis.Women early in pregnancy should undergo surgery, whereas those who are about to deliver should have their hernia dealt with after delivery. Infants and young children should undergo prompt repair of groin herniation because their clinical course is unpredictable. Patients starting peritoneal dialysis commonly became more symptomatic, and therefore prophylactic herniorrhaphy is a good option. Predisposing pathologies of hernia accidents, such as liver disease with ascites and colon cancer, should be considered in the appropriate clinical setting.

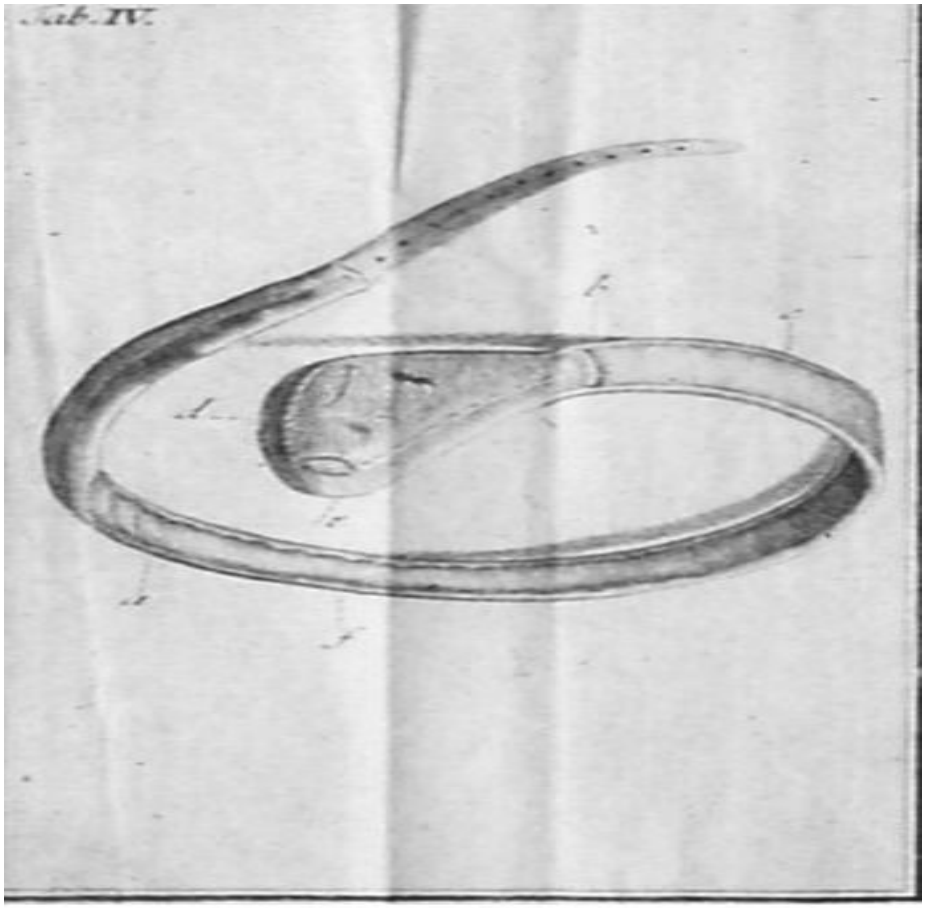


Figure 45-11 Illustration of an older style truss from the 18th century.

Preoperative Preparation

Most patients require no special preparation and can be safely treated as outpatients (day care surgery). Significant comorbid illness should be addressed, as with any surgical procedure. A single dose of preoperative intravenous antibiotics is preferred by many, especially if a prosthesis is to be used. However, there is no conclusive evidence that administration of antibiotics decreases the incidence of wound infection. With large groin hernias, one must be cognizant of the fact that

replacement of hernia contents into the abdominal cavity during herniorrhaphy could be followed by respiratory embarrassment or abdominal compartment syndrome, or both. The term “loss of domain” refers to this clinical scenario and can be addressed by establishment of pneumoperitoneum in preparation for hernia surgery. A CT scan allows the surgeon to determine the extent of domain loss and make a final decision about the need for pneumoperitoneum. The objective of pneumoperitoneum, which is applied in successive sessions, is to increase the amount of room in the peritoneal cavity. Many techniques have been described, including daily needle puncture, placement of an indwelling catheter by a percutaneous system or minilaparotomy, or a completely implanted system involving a tunneled peritoneal catheter and a venous access reservoir. Room air is inflated into the abdominal cavity on a once- or twice-daily timetable to patient tolerance as determined by abdominal discomfort or shortness of breath. Usually, 1 to 2 L is insufflated at each session. Upright chest roentgenography is useful because the level of the diaphragm is a measurable objective monitor.

Potential complications include infection and visceral or vascular injury during placement of the catheter. Furthermore, pneumoperitoneum is not always successful because the insufflated air may preferentially enter the hernia sac and have minimal effect on the abdominal cavity. In addition, pneumoperitoneum has been shown to diminish lower extremity venous return, which could translate into a

higher risk for thromboembolic complications. Deep venous thrombosis prophylaxis is prudent when one is considering this approach.

Anesthesia

Although general anesthesia is almost always recommended for laparoscopic hernia repairs, the choice of anesthesia for open inguinal herniorrhaphy depends on the personal preference of the surgeon. Local anesthesia, when used in adequate doses and far enough in advance, proves very effective, especially in combination with short-acting amnesic and anxiolytic agents such as propofol. The local anesthetic should be injected before preparing and draping the patient for best results. One of the biggest advantages of local anesthesia is that the patient can be aroused from sedation at intervals to perform Valsalva maneuvers and test the repair. Regional anesthesia can also used by some experienced individuals in a successful manner. Local anesthesia can be used at the end of general anesthesia to lessen the postoperative pain.

Choice of Prosthetic Material

As far back as 1878, Billroth envisioned that prosthetic material would be the best solution for the problem of inguinal herniation. Numerous randomized comparative trials, as well as meta-analyses and comprehensive reviews, have

unequivocally proved the superiority of prosthetic repairs over pure tissue repairs in terms of recurrence. Tissue repairs are associated with an irreducible recurrence rate of 5% to 10%. The modern era of hernia repair has seen a progressive decrease in recurrence rates because of improvement in surgical technique and prosthetics. Materials that have emerged as suitable for routine use in hernia surgery and fulfill Cumberland's classic ideal characteristics include polypropylene, either monofilament (Marlex, Prolene) or polyfilament (Surgipro), Dacron (Mersilene), and expanded polytetrafluoroethylene (ePTFE) (Gore-Tex). An absorbable prosthesis has no role in groin hernia surgery. The newer biologic prostheses made of human cadaver skin, porcine cross-linked dermal collagen, or porcine small intestinal submucosa are more expensive and have no proven advantage over synthetic prostheses in uncomplicated groin hernia surgery. However, they can be useful in infected groin hernia wounds. Recently, the development of prostheses that modulate ECM expression by incorporating basic fibroblast growth factor has attracted the attention of investigators.

Cumberland's Characteristics of the Ideal Prosthetic Material

Not modified physically by tissue fluid
Chemically inert
Not carcinogenic
Does not cause an allergic or hypersensitivity response
Resistant to mechanical strain
Pliable and therefore moldable
Easily sterilized

Although foreign body reaction, infection, erosion into surrounding structures, rejection, increased incidence of postherniorrhaphy pain, and even carcinogenesis remained an early concern with the use of prostheses, after nearly 50 years of use it is obvious that these fears are without foundation. The incidence of postherniorrhaphy pain is lower with mesh repairs than with pure tissue repairs. When it occurs, however, it can occasionally be relieved by removal of the prosthesis. Another issue that has recently emerged is the possibility of injury to the vas deferens caused by a reaction to a prosthesis that resulted in infertility in a small subset of patients. This consideration demands careful follow-up. Ironically,

one of the major arguments for the routine use of mesh in inguinal hernia surgery is to preserve fertility.

Approaches to Repair of Groin Hernias

Groin hernia repairs can be performed conventionally (anterior or preperitoneal) or laparoscopically. For conventional operations one can use a prosthesis or a pure tissue technique for repair. Whereas prosthetic approaches are by definition tension-free, avoidance of tension in nonprosthetic repairs is accomplished by relaxing incisions.

Commonly Recognized Conventional Inguinal Hernia Repairs

	Anterior	**Preperitoneal**	**Combined**
Nonprosthetic	Marcy	Original Nyhus-Condon (historical interest only now)	
	Bassini		
	Moloney darn		
	Shouldice		
	McVay-Cooper's ligament repair		

	Anterior	Preperitoneal		Combined
	Miscellaneous			
Prosthetic	Lichtenstein tension-free	Anterior approach	Posterior approach	Bilayer repair
	Hernioplasty	Read-Rives	GPRVS	
	Mesh plug and patch		Kugel	
			Nyhus-Condon	

GPRVS, great prosthesis for reinforcement of the visceral sac.

Conventional Anterior, Nonprosthetic

The initial skin incision is horizontal along the lines of Langer for cosmetic reasons. The incision is deepened through Camper's and Scarpa's fascia to the external oblique aponeurosis. This structure is incised medially to and through the external ring. The superior flap of the external oblique is bluntly swept off the internal oblique muscle laterally and superiorly. The ilioinguinal and iliohypogastric nerves are identified and preserved. The cord structures are then separated from the external oblique aponeurosis by blunt dissection so that the inguinal ligament is exposed.now all those structures are lifted gently near pubic tubercle so that both fingers can meet at the bottom side confirming it.

A Penrose drain is placed around the cord for retraction. Most surgeons would now avoid complete division of the cremasteric muscle and instead open it longitudinally to expose the inguinal floor. This avoids testicular descent in the postoperative period. High ligation of the sac performed by formal division and transfixion or simply inverting the sac into the preperitoneal space follows. The latter technique avoids injury to unrecognized incarcerated sac structures and decreases the risk for adhesive complications. It is questionable whether pain is lessened by the simple inversion technique, which avoids incision of the richly innervated peritoneum. A small indirect inguinal hernia sac is completely mobilized and excised or inverted into the preperitoneal space. For a larger indirect hernia or an inguinal-scrotal hernia, the sac should be divided in the inguinal canal. The proximal end can be inverted or excised, but the distal end should not be removed to avoid injury to the testicular blood supply. The anterior wall of this distal sac needs to be opened as far distally as possible..In contrary to our popular belief from urology, this technique does not increase the incidence of hydrocele formation. Tanner described a relaxing incision in the anterior rectus sheath that extends from the pubic tubercle superiorly for a variable distance as determined by the tension. This incision works by allowing the various components of the abdominal wall to displace laterally and inferiorly. The rectus muscle itself is strong enough to prevent future herniation. The external oblique fascia is closed to

form the superficial inguinal ring tight enough to avoid a so-called industrial hernia, but slightly loose to avoid strangulation of the cord structures. The term industrial hernia refers to the presence of a dilated external ring that an inexperienced examiner confuses with a hernia.

The Bassini Repair

The Bassini repair involves separation of cremastric fibres and then resection of the indirect sac while simultaneously exposing the floor of the inguinal canal to assess for a direct hernia. The transversalis fascia in the floor of the inguinal canal is divided along its full length. This ensures adequate inspection for a femoral hernia and results in preparation of the deepest layer of Bassini's classical triple layer (the fascia transversalis, the transversus abdominis, and the internal oblique muscle). After the sac is highly ligated, the posterior wall is reconstructed with suturing this triple layer medially to the inguinal ligament and possibly the iliopubic tract laterally. Usually sitches are taken from superiorly from the muscle layer and medially from the pubic tubercle periosteum some surgeons avoid taking stitch from periosteum inorder to avoid osteitis pubis. Laterally, the alighnment ends with closure of the internal ring. In the classic Bassini procedure the suture material used for the repair was silk placed in interrupted fashion. As described earlier, the Bassini operation could be considered a preperitoneal repair,

but the American version does not involve opening the transversalis fascia (inguinal floor), hence its classification as a conventional anterior procedure. In lieu of opening the floor, forceps is used to blindly take the structures like fascia transversalis and abdominis and sutured with the superior muscle layers and inferiorly to the inguinal ligament. Because of anatomic variations among individuals, the structures grasped superiorly are not always consistent. Students of Bassini believe that it is this variability that is the reason for the lesser results achieved with this techniques in North America. Perhaps the need to develop better herniorrhaphies would not have been so pressing if Bassini's operation had been practiced as he described it. The McVay Cooper's repair is similar to the above technique except the stitch is taken from coopers ligament for the medial alighnment.then some interrupted stitches taken from coopers ligament inorder to narrow the femoral ring. The final stitch including the coopers ligament with the inguinal ligamentt. The stitch effectively narrows the femoral ring and allows a step-up to the inguinal ligament over the femoral vessels and hence the repair is done and towards laterally. A Tanner slide (a relaxing incision on the anterior rectus sheath) is essential because there is considerable tension associated with this repair. It is indicated for the repair of femoral hernias or large direct inguinal hernias with extensive destruction of the inguinal floor when a mesh would be contraindicated, such as infection.

The Moloney Darn

The Moloney darn and its variant the Abramson darn use nonabsorbable suture to form a meshwork over the inguinal floor. The interstices of this meshwork fill with fibrous connective tissue that buttresses the weakened area of the inguinal canal. The initial layer consists of a continuous nylon suture to appose the transversalis fascia and the transversus abdominis, rectus, and internal oblique muscles medially to the reflected portion of the inguinal ligament laterally, similar to a Bassini repair. A difference is that the first stitch taken into cord muscle and continued in and out around the cord finally tied to the lateralside of internal ring including inguinal ligament. on the lateral side of the internal ring. The darn is a second layer with sutures applied in a crisscross fashion through muscular tissue medially to the inguinal ligament. Abramson stresses the importance of leaving the suture loose and not forcing the edges of the repair together during the darn, thereby allowing a “tension-free” repair and maintaining the meshwork structure. The darn must be carried well over the medial edge of the inguinal canal onto the anterior rectus sheath.

The Shouldice Technique

The Shouldice Clinic in Toronto serves as a model specialty clinic where hernia repairs are combined with weight reduction and exercise programs. The

initial approach is similar to the Bassini repair, much of the importance given to release cord from the surrounding adhesions and dissection of cremaster and sac ligation highly. Steel wire is used and woven continuously for the floor to ensure even distribution of tension and avoid the defects that could potentially occur between interrupted sutures.the first stitch is taken from the pubictubercle and in continous fashion it was carried out laterally upto the internal ring approximatingthe superior muscle layer with the illiopubic tract and then it was carried out in reverse fashion towards pubic tubercle.next layer isapproximating the superior muscle layer in view of an artificial inguinal ligament like support. The fourth layer is organized in a similar technique above the third layer,inorder to get hold of external oblique muscle cribriform fascia can be incised.. When performed by experienced surgeons at the Shouldice Clinic, the operation has a recurrence rate of less than 1% and was the other techniques were compared to this standard technique. The major criticisms are that it is difficult to teach and it is hard for surgeons to understand what is really being sewn to what. This is further compounded by the fact that modifications outside the Shouldice Clinic have resulted in different versions.

Conventional Anterior, Prosthetic

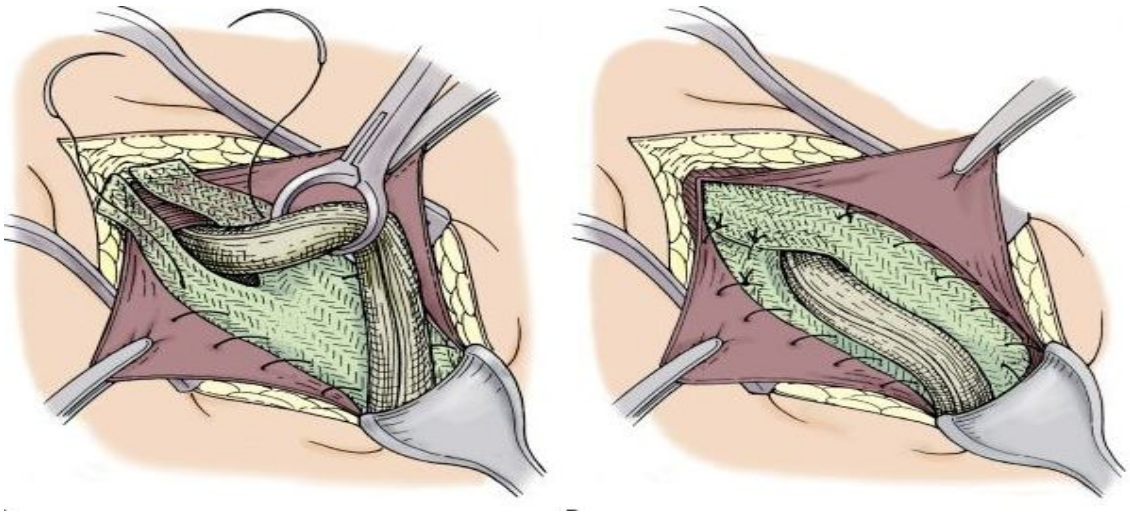
Lichtenstein Technique

The Lichtenstein Clinic is dedicated to hernia repairs. The herniorrhaphy is performed under local anesthesia with sedation. The former steps are similar to those of the Bassini repair. After the external oblique aponeurosis is opened,the inferior muscle layers is separated in aavascular plane.then the cord structures which contains cord with testicular vessel and nerves was held up by fingers . The effect is to create a large space for eventual placement of the prosthesis and at the same time provide excellent visualization of the nerves.

High ligation is performed by dissecting the sac from the surrounding cord structures after incising the cremaster muscle longitudinally. Direct hernias are separated from the nearby adhesions and the contents were returned back space. Superficial layers of sac were divided and facilitates reduction and aids in maintaining the reduction while the prosthesis is being placed. A suture can also be placed to allow the repair to proceed unencumbered by the sac protruding into the operative field.mesh of approximate size to thedefect taken and fixed to rectus sheath and secured on both sides and continued along the shelving edge in a running locking fashion. The suture is tied at the internal ring.

The mesh end is divide into two tails awider and a narrower and they are positioned in such amanner one above another inorder to prevent the recurrence of indirect inguinal hernia, that is seen when simple reapproximation of the tails

is performed. This shutter valve suture should also pass through the shelving edge to allow the mesh to buckle medially over the direct space and avoid tension when the patient stands upright. A few interrupted sutures are then placed to secure the superior and medial aspects of the mesh to the underlying internal oblique and fascia. Care should be taken to avoid placing anchoring suture through the iliohypogastric nerve. Sufficient laxity should be maintained in the prosthesis to account for the difference in tension between the supine and prone positions and to compensate for mesh shrinkage. The only potential drawback of this procedure is that a femoral hernia could be missed because the inguinal floor is not opened. If one is detected, both the inguinal and coopers ligament were approximated.



Plug and Patch (Rutkow) Technique

The mesh plug technique was found by Gilbert and then modified by Robbins and Rutkow. The sac is separated from the adhesions and with the contents were returned back after a standard anterior approach. A plug made of rolled polypropylene mesh or prefabricated in the configuration of a flower is inserted into the defect and secured to its edges by interrupted suture. Millikan suggests that the inner leaf were sutured with the preperitoneal side and the mesh on the outside hence it will act as a underlay.. For an indirect hernia, the plug is held in place with three or four sutures around the defect . For direct hernias, fascia transversalis is opened to facilitate plug placement. The patch portion can be kept in a flat manner which wil support the plug in a fashion similar to the Lichtenstein procedure. The technique fast and also easy to teach in both academic and private centers.

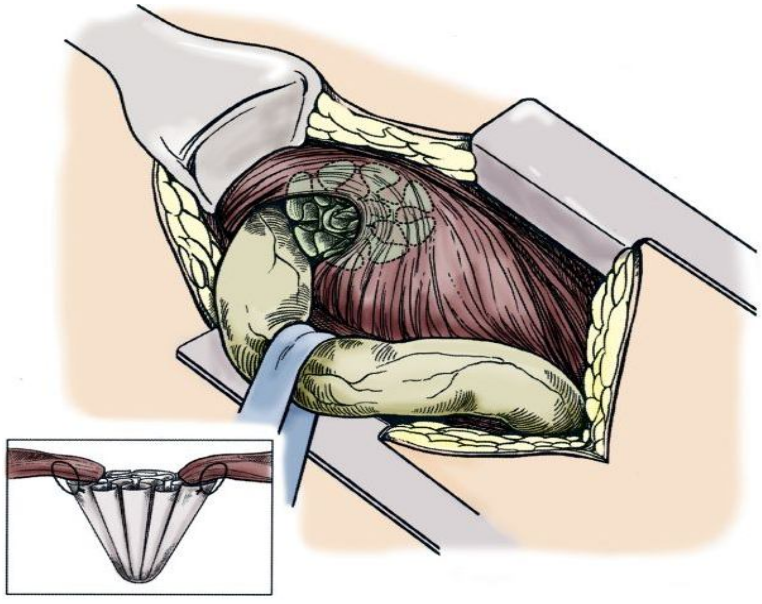


Figure 45-13 Plug and patch technique: plug placement for an indirect inguinal hernia. The *inset* shows a sagittal view of the implanted plug.

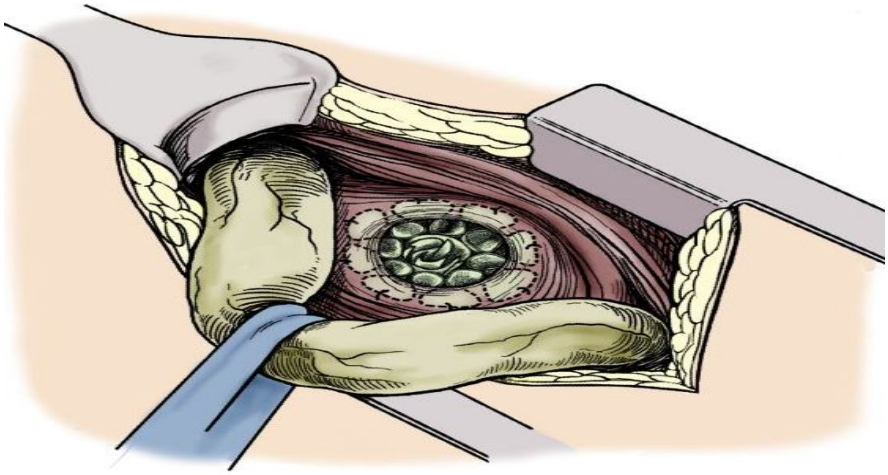


Figure 45-14 Plug and patch technique: plug placement for a direct inguinal hernia.

Conventional Preperitoneal Prosthetic

The key to preperitoneal repairs is to place a prosthetic in the fascio peritoneal space. This preperitoneal space can be entered from either the anterior or the posterior aspect. In the anterior approach a groin incision is made and the space is entered directly through the inguinal floor. A midline, Pfannenstiel, or paramedian incision can be used to enter the space from the posterior aspect. The transabdominal approach as advocated by LaRoque has returned to popularity because of the ease of entering the space laparoscopically.

Anterior Approach (Read/Rives)

This operation starts like a classic Bassini procedure, including opening the inguinal floor. Dissection were carried out laterally toinferior epigastric vessels and the cord is skeletonized then a mesh is positioned in the pre peritoneal space and secured with sutures and the cord structures replaced before closure.

Posterior Approach

Great Prosthesis for Reinforcement of the Visceral Sac

The procedures described by Wantz, Stoppa, and Rives are grouped together under the heading of great prosthesis for reinforcement of the visceral sac because they have only minor variations. These repairs are used for bilateral hernias, recurrent hernias, and diffuse abdominal wall weakness associated with collagen disorders. A lower midline, transverse or Pfannensteil incision can be used according to surgeon interest. If a transverse incision is chosen, it should extend from the midline 8 to 9 cm in each direction laterally and 2 to 3 cm below ASIS and the oblique muscles are divided in parallel manner. The preperitoneal space is entered by incising the fascia transversalis along the lateral edge of the rectus muscle or by incising the fascia overlying the space of Retzius. Lateral to ASIS dissection is carried out in preperitoneal space. The symphysis pubis, Cooper's ligament, and iliopubic tract are identified. The spermatic cord is “parietalized” (completely dissected) to provide adequate length to displace it laterally. Direct sacs are reduced in the course of this dissection. Indirect sacs aredissected from cord all their contents were retduced into abdominal cavity. Large sacs may be difficult to mobilize and may be divided so that the distal part of the sac is left in situ and the proximal portion of the sac is dissected away from the cord structures. Care should be taken during the course of this dissection to avoid damage to the

testicular vessels. It must be particularly emphasized that the dissection should proceed in the relatively avascular plane between the fascia transversalis and the peritoneum to avoid a bloody procedure.

Stoppa and Wantz recommend that the abdominal wall defect be left alone, but other surgeons prefer to plicate the fascia transversalis with the coopers to avoid the seroma bulge.

The next step is placement of the prosthesis. Dacron mesh is preferred over polypropylene by many European surgeons because they believe that it conforms better to the preperitoneal space. The size of the prosthesis for unilateral repairs is approximately the distance between the umbilicus and the anterior superior iliac spine minus 1 cm for the width, with the height being approximately 14 cm. Because of his extensive parietalization of the cord structures, Stoppa does not think that it is necessary to split the prosthesis laterally to accommodate the cord structures, and this avoids potential recurrence through the keyhole. Wantz recommends cutting the prosthesis eccentrically, with the lateral side longer than the medial, to achieve the best fit in the preperitoneal space. Rignault, on the other hand, prefers a keyhole defect in the mesh to encircle the spermatic cord in the belief that this technique provides the prosthesis with assurance that fixation stitches or tacks can be avoided. Minimizing fixation in this area is important

because of the numerous anatomic elements in the preperitoneal space that could be inadvertently damaged during suture or tack placement. For Wantz's technique, three absorbable sutures areused tosuture the superior layer of wall of abdomen with the mesh. The three sutures are placed near the linea alba, semilunar line, and anterior superior iliac spine in a medial-to-lateral direction. A Reverdin suture needle facilitates such placement. Subsequently, the mesh is positioned to cover the iliac fossa and the parietalized cord structures and iliopsoas muscle laterally; the pubic ramus, obturator fossa, and iliac vessels medially; and the space of Retzius in the middle. The size of the mesh for the Stoppa technique to repair bilateral hernias is the distance between the two anterior superior iliac spines minus 2 cm for the width, and the height is equal to the distance between the umbilicus and the pubis. The wound is closed in layers.

Nyhus/Condon (Iliopubic Tract Repair)

These two authorities performed extensive cadaver dissections and pointed out the importance of the iliopubic tract. A transverse lower abdominal incision is made two fingerbreadths above the pubic symphysis. The anterior rectus sheath is opened on its lateral side to allow the rectus muscle to be retracted medially, and the two oblique and the transversus abdominis muscles are incised to expose the fascia transversalis. A combination of sharp and blunt dissection inferiorly opens

the preperitoneal space and exposes the posterior inguinal floor. Direct or indirect defects are repaired similarly after the peritoneal sac has been reduced or divided and closed proximally. The transverse aponeurotic arch is sutured to the iliopubic tract inferiorly, with Cooper's ligament occasionally included in the medial portion of the repair. The internal ring, if large, is also narrowed by placing a suture lateral to it. For femoral hernias the iliopubic tract is sutured to ligament of cooper. Once the defect has been formally repaired, a tailored mesh prosthesis can be sutured to Cooper's ligament and the fascia transversalis for support.

Kugel/Ugahary Repair

These operations were devised to compete with laparoscopy by using a small 2- to 3-cm skin incision above the internal ring. Kugel locates this point by making an oblique incision nearly halfway between the anterior superior iliac spine and the pubic tubercle.incision was deepened to divide the external oblique vertical opening of fascia transversalis fascia is done. The inferior epigastric vessels are identified to ensure that the dissection is in the correct plane. The vessels are usually found to the overlying fascia. The cord structures are thoroughly parietalized, and anatomic landmarks, including the iliac vessels, Cooper's ligament, pubic bone, and hernia defect, are identified by palpation. Most direct and small indirect sacs are reduced by such dissection; large indirect sacs are

often divided with the distal end being left in situ while the proximal end is reduced. A specifically designed 8- by 12-cm prosthesis made of two pieces of polypropylene is altered in such a way to cover the myopectineal orifice. Ugahary's operation is similar, but a special prosthesis is not needed.

Combination Anterior and Preperitoneal Approaches (Bilayer Technique)

This repair depends on a dumbbell-shaped device consisting of two flat prolene mesh both are connected . The basis of this design is to take advantage of the benefits of both the anterior and posterior approaches, because the mesh is kept in such a way in the preperitoneal plane similar to the technique of lichenstein.this prosthetic is divided toaccomodate cord laterally with three or four interrupted sutures to the area of the pubic tubercle, the middle of the inguinal ligament, and the internal oblique muscle.

COMPLICATIONS

General complications such as urinary retention, paralytic ileus, and cardiorespiratory compromise can follow any operative procedure, and inguinal herniorrhaphy is no exception. The most common is urinary retention, especially after general anesthesia.

Postherniorrhaphy Complications After Conventional Repair

Recurrence

Chronic groin pain

- Nociceptive
- Neuropathic

Cord and testicular

- Hematoma
- Ischemic orchitis
- Testicular atrophy
- Injury to the vas deferens
- Hydrocele
- Testicular descent

Bowel and bladder injury

Osteitis pubis

Prosthetic complications

Contraction Erosion Infection Rejection Fracture Miscellaneous complications Seroma Hematoma Wound infection General complications

Chronic Postherniorrhaphy Pain Syndromes

Chronic postherniorrhaphy groin pain is the pain which persists formore than 90days. The overall incidence is about 25%, with 10% fitting the definition of moderate or severe pain that prevents the subject from returning to the preoperative level of functioning or is frankly incapacitating. Patients are difficult to categorize because of the heterogeneous description of their pain; nevertheless, an attempt

should be made to assign them to one of two groups to help determine therapeutic options: (1) nociceptive pain caused by tissue injury, which is further subdivided into somatic and visceral, and (2) neuropathic pain secondary to nerve damage.

Somatic pain is usually caused by damage to ligaments, tendons, and muscles and includes osteitis pubis and adductor tenoperiostitis. Visceral pain refers to specific visceral dysfunction such as dysejaculation and urinary dysfunction. The principles of treating patients with nociceptive pain are similar to those for patients with groin pain but no obvious hernia.

Division, stretching, contusion, crushing, entrapment, or electrical injury to the nerve causes neuropathic groin pain. The nerves most commonly injured during conventional herniorrhaphy are the ilioinguinal and iliohypogastric. The classic manifestation is pain or paresthesia (or both) in the distribution of one of the major nerves. Precise diagnosis of nerve involvement is difficult because of dermatomal overlap. Physical activity aggravates the pain, and a recumbent position with hip flexion relieves it. Reassurance plus conservative treatment with anti-inflammatory medications and local nerve blocks is preferred initially. At least 1 year of conservative treatment should be tried before offering neuroma excision or neurectomy.

Recurrent Hernias

The hernia recurrence rate with the use of prosthetic material is less than 1%. This rate is probably an underestimation of the problem because patients frequently do not return to their original surgeon. It still translates to a hefty number because of the size of the denominator. A recurrent hernia is usually manifested as a bulge with a cough impulse. Occasionally, the initial symptom is pain. In this situation, a consistent definition of recurrent hernia does not exist because of difficulty differentiating a lipoma of the cord, a seroma, or an expansile bulge of the internal oblique muscle from true hernia recurrence. Imaging in the form of CT, MRI, or ultrasound should be obtained to unequivocally document recurrence. Causes of recurrence include (1) failure to perform high ligation or reduce the peritoneal sac with an indirect hernia, (2) inadequate closure of the internal ring, (3) missed hernias, (4) continuing failure of the floor of the canal, and (5) infection. The general principle for managing recurrent hernias depends on the original repair. The logical approach is to perform herniorrhaphy in the space that has not been dissected. If the patient has previously undergone a conventional repair, a preperitoneal repair is best chosen. On the other hand, if the index operation was a preperitoneal one, a repair that is performed in the conventional inguinal space is best.

Cord and Testicular Injury

Ischemic orchitis is the inflammation of testicles which develop post operatively usually one to five days after operation. It is thought to result from thrombosis of veins draining the testicle secondary to extensive dissection of the spermatic cord. It is much more common after repair of recurrent hernias. Initial symptoms like pyrexia with testis pain. Management is supportive and consists of support to testis . Ischemic orchitis usually resolves without sequelae but may occasionally progress to testicular atrophy. It is generally accepted that dividing rather than excising large indirect inguinal-scrotal hernia sacs and leaving the distal part of the sac open in situ can decrease the incidence of testicular complications.

The dysejaculation syndrome is defined as a burning, searing, painful sensation occurring just before, during, or after ejaculation (or any combination). A stenotic lesion in the vas deferens probably causes it. The condition is usually self-limited, and thus the initial treatment is expectant. Injury to both vasa is a potentially devastating complication after bilateral hernia repair. If injury to the vas is recognized during herniorrhaphy, reanastomosis should be attempted if paternity is an issue. Even unilateral injury to the vas can result in infertility as a result of the development of sperm antibodies in response to extravasated sperm. Scrotal hematomas can occur after herniorrhaphy as a consequence of cremasteric or vascular hemostatic errors. Postherniorrhaphy hydroceles can develop, but the

cause is not known. Although the urologic literature suggests that hydroceles develop in case of leaving the last region of sac.

Prosthetic Complications

Shrinkage of prosthetic material because of scarification of the recipient's tissues should be anticipated during herniorrhaphy. Sufficient overlap in anticipation of 20% contracture is recommended. Mesh migration of prolene into other organs are rare. Intra-abdominal placement of a mesh prosthesis should be avoided in favor of an ePTFE or biologic prosthesis to avoid fistulation or bowel obstruction. Local erosion into cord structures has been reported. Rejection because of allergic reactions is extremely rare and is probably a manifestation of chronic infection.

Bowel and Bladder Injury

Bladder and bowel injury is unusual with conventional anterior herniorrhaphy unless a sliding hernia goes unrecognized during repair. The bladder is at much greater risk during preperitoneal procedures, especially in the setting of surgery in Retzius space. Previous surgery in this space can be considered a relative contraindication to preperitoneal repair. Bladder injuries need to be repaired in two layers with absorbable suture, followed by extended Foley decompression until a cystogram confirms bladder integrity.

wound Infection :

The groin appears to be a protected area inasmuch as wound infection after inguinal herniorrhaphy occurs in less than 5% of patients. However, this figure may be an underestimation of the true incidence because of a delayed manifestation in many cases. Most surgeons recommend prophylactic broad-spectrum antibiotics, although studies by the Cochrane group have shown no benefit. Whereas infection after nonprosthetic repairs can be managed by open drainage and dressing changes, prosthetic removal is commonly required in addition to routine wound care after prosthetic procedures. , but true meshes can on occasion be with conservative wound care and antibiotic treatment.In caseof infection .

LAPAROSCOPIC OR CONVENTIONAL INGUINAL HERNIORRHAPHY

In the lastdecades there was much comparison between the laparoscopy and the standard repair and trials also provedlaparoscopic technique superior than the open techniques and better cosmesis, and return to normal activities sooner.

Comparative Trials of Laparoscopic and Open Inguinal Hernia Repair Using Mesh

Author	**Hernias *(n)* LH vs. OH**	**Intervention**	**Recurrence Rate (%)**	**Salient Results**
Horeyseck et al.,	100 vs. 100	TAPP vs. Lichtenstein	8 vs. 0	Higher recurrence, higher cost
Zieren et al.,	86 vs. 105	TAPP vs. PP	2.3 vs. 0	Recuurence rate higher
Sarli et al.,	64 vs. 66	TAPP vs. Lichtenstein	0 vs. 0	Complications were similar
Champault et al.,	50 vs. 50	TAPP vs. Stoppa	6 vs. 2	Recurrence rate higher
Khoury,	169 vs. 146	TAPP vs. MP	2.5 vs. 3	Recurrence rate higher
Paganini et al.,	52 vs. 56	TAPP vs. Lichtenstein	2 vs. 0	Similar return to normal activity, higher cost
Aitola et al.,	24 vs. 25	TAPP vs. Lichtenstein	13 vs. 8	Higher recurrence rate
Picchio et al.,	53 vs. 52	TAPP vs. Lichtenstein	Not mentioned	High pain scores

Author	Hernias *(n)* LH vs. OH	Intervention	Recurrence Rate (%)	Salient Results
Kumar et al.,	25 vs. 25	TEP vs. Lichtenstein	4 vs. 8	*Nonrandomized,* lower pain score, fewer local complications
Johansson et al.,	613 total	TAPP vs. preperitoneal mesh vs. conventional	2 vs. 5.5 vs. 2	Similar complications
MRC group,	468 vs. 460	TEP vs. mainly tension-free	1.9 vs. 0	Earlier resumption of normal activity, less long-term pain, higher recurrence rate
Beets et al.,	56 vs. 52	TAPP vs. Stoppa	12.5 vs. 1.9	Less pain, fewer early complications
Sarli et al.,	40 vs. 46	TAPP vs. Licttenstein	0 vs. 4.3	Less pain, earlier return to work
Wright et	145 vs. 151	TEP vs. mostly	2 vs. 2	Similar recurrences,

Author	Hernias *(n)* LH vs. OH	Intervention	Recurrence Rate (%)	Salient Results
al.,		Lichtenstein		similar missed contralateral hernias
Pikoulis et al., []	309 vs. 234	TAPP vs. MP	1.9 vs. 0.4	*Nonrandomized,* higher cost, higher recurrence rate
Mahon et al., []	60 vs. 60 (all bilateral or recurrent)	TAPP vs. Lichtenstein	6.7 vs. 1.7	Shorter operative time, less pain, earlier return to work
Andersson et al.,	81 vs. 87	TEP vs. Lichtenstein	2.5 vs. 0	Similar complications, earlier return to work, less pain, higher recurrence rate
Douek et al.,	122 vs. 120	TAPP vs. Lichtenstein	1.6 vs. 2.5	Less groin pain, less frequent paresthesias
Bringman et al.,	Total *N* = 298	TEP vs. MP vs. Lichtenstein	1.3 vs. 1.3	Shorter sick leave period, less time to full

Author	Hernias *(n)* LH vs. OH	Intervention	Recurrence Rate (%)	Salient Results
				recovery
Lal et al.,	25 vs. 25	TEP vs. Lichtenstein	0 vs. 0	Earlier return to work better cosmesis, similar recurrence rate
Heikkinen et al.,	62 vs. 61	TAPP vs, Lichtenstein	8 vs. 3.2	Similar recurrence rate, less long-term groin pain
Neumayer et al.,	862 vs. 834	TAPP/TEP vs. Lichtenstein	10.1 vs. 4	Less pain, higher recurrence rate for primary hernias

IPOM, intraperitoneal onlay mesh repair; LH, laparoscopic hernia repair; MP, mesh plug repair; OH, open hernia repair; PP, patch plug repair; TAPP, transabdominal preperitoneal hernia repair; TEP, totally extraperitoneal repair.

Comparative Trials of Laparoscopic and Open Tissue-Based Inguinal Hernia Repair

Author	Hernias *(n)* LH vs. OH	Intervention	Recurrence Rate (%)	Salient Results
Lawrence et al.,	58 vs. 57	TAPP vs. Maloney darn	Not mentioned	Less pain, higher cost, similar return to work
Vogt et al.,	30 vs. 32	IPOM vs. Bassini/McVay	3 vs. 6	earlier return to normal activity
Liem et al., []	487 vs. 507	TEP vs. mostly tissue repairs	3 vs. 6	Few complications
Dirksen et al.,	114 vs. 103	TAPP vs. Bassini	6 vs. 21	Recurrence rate lower
Tanphiphat et al.,	60 vs. 60	TAPP vs. modified Bassini	1.5 vs. 0	Lesser postop pain
Zieren et al.,	80 vs. 80 vs. 80	TAPP vs. MP vs. Shouldice	0 vs. 0 vs. 0	Less pain
Juul et al.,	138 vs. 130	TAPP vs. Shouldice	2.9 vs. 2.3	Recurrence rate lower

Author	Hernias *(n)* LH vs. OH	Intervention	Recurrence Rate (%)	Salient Results
Leibl et al.,	48 vs. 43	TAPP vs. Shouldice	2 vs. 5	Greater patient satisfaction, similar recurrence rates
Tschudi et al.,	51 vs. 49	TAPP vs. Shouldice	3.9 vs. 10.2	Recurrence rate lower
Wennstrom et al.,	131 vs. 130	Tep vs. Shouldice	Similar	Recurrence rate lower

IPOM, intraperitoneal onlay mesh repair; LH, laparoscopic hernia repair; MP, mesh plug repair; OH, open hernia repair; TAPP, transabdominal preperitoneal hernia repair; TEP, totally extraperitoneal repair.

The advantages attributed to the laparoscopic approach must be compared to its fearsome complications like vessel or organ injury, increased cost because of expensive equipment, increased operating room time, and the need for general anesthesia. Many of the recent randomized trials show a recurrence rate with laparoscopic repair comparable to that of conventional tension-free repair. However, most have been conducted at single centers with a keen interest in

laparoscopic surgery. A notable exception to these trials is a recently published multicenter trial conducted in the Veterans' Administration system in which laparoscopic preperitoneal hernia repair (mostly TEP) was compared with tension-free anterior (Lichtenstein) repair. Recurrence was higher in laparoscopicapproach but incase ofrecurrent hernias both were similar. This particular study holds importance for surgeons practicing outside a specialty laparoscopic center and has caused many to suggest that the laparoscopic approach should be performed only at centers with a special interest. The early and delayed complication rates of the laparoscopic and conventional approaches are similar, but the seriousness of complications in the laparoscopic approach can be far greater. The hospital cost of laparoscopic repair is significantly higher than that of conventional repair, but it may be somewhat compensated by the higher productivity attributable to earlier return to work.

Patient Selection

Laparoscopic inguinal herniorrhaphy is technically more challenging than a tension-free anterior repair and thus has a steep learning curve. Consequently, patient selection for the procedure is heavily dependent on the surgeon's experience and his skill.all the patients fit for undergoing surgery by general anesthesia were fit for lap repair. Intra abdominal sepsis,bleeding disorders were absolute

contraindications. History of surgery, fluid collection in abdomen were relative contraindications. Incase of adhesions due to previous surgery one must be very careful regarding bowel and bladder injury. However, in the absence of considerable experience, a conventional approach may be preferred.

Operative Strategies

A laparoscopic hernia repair in which the peritoneal cavity is initially entered and the preperitoneal space is entered by another incision into the peritoneum from within the abdomen is called a *transabdominal preperitoneal,* or TAPP, repair. The next commonly used type of laparoscopic inguinal hernia repair is the *totally extraperitoneal,* or TEP, repair. Here abdominal cavity is not entered in this approach, and thus true laparoscopy is not performed; however, because a laparoscope and related instruments are used, it is appropriate to discuss this operation here. An inguinal hernia repair that is performed by placing mesh intraperitoneally over the defect via a laparoscopic approach is labeled an *intraperitoneal onlay mesh,* or IPOM, repair.

Transabdominal Preperitoneal Repair

The TAPP procedure is begun with placement of a Hasson cannula at the umbilicus under direct vision. Thorough diagnostic laparoscopy is performed to rule out any unrelated pathology, and both myopectineal orifices are inspected.

Two additional 5-mm laparoscopic ports are placed on either side of the umbilical cannula just lateral to the rectus sheath. This assumes the availability of a 5-mm fastening device. If a 10-mm instrument is to be used for this purpose, one of the lateral cannulas will need to be 10 mm. If the hernia is unilateral, a transverse incision of the peritoneum is begun on the lateral side of the medial umbilical ligament. The lateral leaf of the ligament is opened and the peritoneum is incised to a point medial to the anterior superior iliac spine while staying approximately 2 cm above the internal inguinal ring and the hernia defect. The medial umbilical ligament can be divided if needed and the remnant of the obliterated fetal umbilical artery controlled with electrocautery. Extensive, mostly blunt dissection is performed in the preperitoneal space. The use of electrocautery to prevent bleeding is especially helpful because bleeding interferes with adequate visualization by absorbing the light. It is important to dissect beyond the symphysis to the contralateral side to achieve sufficient overlap of all medial hernia openings. Both pubic tubercles, the inferior epigastric vessels, ligament of cooper, and the iliopubic tract are identified. The spermatic cord structures are mobilized and the peritoneal flap is dissected well proximal to the bifurcation of the vas deferens and the internal spermatic vessels. If the inferior peritoneal flap is not adequately mobilized, the mesh is prevented from laying flat or the inferior edge of the mesh will roll up when the peritoneum is closed. This has been identified as an important

mechanism of recurrence with the TAPP procedure. A direct hernia sac is easily reduced during the preperitoneal dissection. A small indirect hernia sac can be dissected away from he cord structures and reduced. A larger sac needs to be divided at a suitable point distal to the deep inguinal ring, with only the nearby portions were divided from the cord structures. No effort is made to disturb the distal part of the sac because it may lead to unnecessary vascular disruption, which can result in hematoma formation, ischemic orchitis, testicular atrophy.

A large piece of prosthesis (at least 15 × 10 cm) is placed so that the entire myopectineal orifice is generously covered. At this point one must not forget about the femoral space. Slitting of the mesh laterally to create a new deep ring is optional. There is no conclusive evidence that such slitting confers any advantage over the technique of simply placing the unslit mesh over the internal ring. However, if the mesh is slit, it is important that it be adequately repaired around the cord structures because this step has been incriminated in recurrence. The need for mesh fixation is another controversial subject. Most surgeons believe that the possibility of mesh shrinkage or migration mandates the use of staples, tacks, anchors, or biologic glue.If fixation is chosen, it is begun at the contralateral pubic tubercle and extended medially onto the anterior abdominal wall at least 2 cm superior to the hernia defect, laterally to the anterior superior iliac spine, and to the tissue just above Cooper's ligament inferiorly. Staples, tacks, or anchors should

never be placed below the iliopubic tract when lateral to the internal spermatic vessels because of the possibility of nerve damage and neuralgias. For the superior border of the mesh, staples are placed in horizontal fashion to prevent trauma to the ilioinguinal and iliohypogastric nerves, which also run horizontally. Lateral staples are oriented vertically because the femoral branch of the genitofemoral nerve and the lateral cutaneous nerve of the thigh run in this direction. Meticulous peritoneal coverage of the prosthesis is essential, and hence lowering the pressure of the pneumoperitoneum and further undermining of the inferior peritoneal flap may be necessary. The goal is isolation of the prosthesis from the viscera, and if it is not possible to reapproximate the superior and inferior peritoneal flaps, the inferior flap should be tacked to the transversalis fascia after ensuring complete mesh coverage. If all else fails, omentum can be used to cover the exposed mesh.

For bilateral inguinal hernias, both preperitoneal spaces are dissected. The median umbilical ligament is left undisturbed to avoid the theoretical complication of dividing a patent urachus. However, because both preperitoneal spaces communicate with each other above the symphysis pubis, a single piece of mesh (approximately 30 × 10 cm) can be used to cover the entire lower portion of the pelvis. Some surgeons choose two single flaps mesh for ease of handling, and there does not appear to be a significant increase in the recurrence rate.

Totally Extraperitoneal Repair

A three-trocar approach for the TEP repair is also used. A 10-mm umbilical incision is deepened to either the ipsilateral or the contralateral anterior rectus sheath, depending on surgeons opinion. The rectus sheath is opened and the rectus muscle retracted laterally. The posterior sheath is visualized. Blunt dissection is now begun between the rectus muscle and the posterior rectus sheath with a blunt dissector or a finger while aiming toward the symphysis pubis. A blunt Hasson cannula with a laparoscope is introduced into the space between the bothrectussheaths. It is aimed beyond the superior third of the distance between the umbilicus and the pubic symphysis. This maintains the tip of the trocar to be placed below to the arcuate line. The cannula is now advanced at a 30-degree angle towardssideof bulge. Gentle side-to-side movements of this assembly are used to dissect this preperitoneal space. Care must be taken to avoid aiming too far posteriorly because the bladder may be injured. Once adequate space has been created, two more ports are placed, one approximately 5 cm above the pubis symphysis and the other midway between the umbilicus and the pubis symphysis. Dissection of the preperitoneal space is now completed under direct vision. Popular technical variations include the use of a saline- or air-filled balloon to dissect the preperitoneal space and placement of the two accessory ports on either

side of the midline as in the TAPP repair. One of the advantages of the balloon device is that the preperitoneal space can be visualized through the transparent structure of the balloon. A disadvantage is a higher incidence of dissection in front of the inferior epigastric vessels, which causes them to be reduced with the peritoneal flap. This can complicate exposure. Once the preperitoneal space has been completely developed, treatment of the hernia sac and its contents, parietalization, and placement of the mesh proceed in an fashion identical to that for the TAPP repair.

Potential advantages of the TEP procedure are avoidance of complications associated with entering the peritoneal cavity, including visceral injury, intra-abdominal vascular injury, adhesion formation, and trocar site hernias. Perhaps most important, peritoneal closure does not have to be performed, which eliminates one of the more difficult aspects of the TAPP repair and greatly speeds up the operation. However, the operative space is limited and the anatomy is less easily understood than with the TAPP procedure, thus leading to a slower learning curve. Previous lower abdominal surgery can be a relative contraindication to the TEP repair. Studies comparing the TAPP and TEP repairs have not shown consistent superiority of one approach over the other. Surgeon expertise with a particular procedure may be the key to consistent good results.

Comparative Trials of Different Types of Laparoscopic Inguinal Hernia Repair

Author	Hernias *(n)*	Intervention	Recurrence Rate (%)	Salient Results
Fitzgibbons et al.,	Total 869	TAPP vs. IPOM vs. TEP	4.5 vs. 4.5 vs. 4.5	Similar complication and recurrence rates
Khoury,	60 vs. 60	TAPP vs. TEP		Postop pain more in TAPP
Ramshaw et al.,	300 vs. 300	TAPP vs. TEP	2 vs. 0.3	Increased vascular injury and recurrence with TAPP
Kald et al.,	393 vs. 98	TAPP vs. TEP	1.5 vs. 1	Complications were morein TAPP
Sarli et al.,	59 vs. 56	TAPP vs. IPOM	0 vs. 11.1	Recurrence lower in TAPP
Van Hee et al.,	33 vs. 58	TAPP vs. TEP	2.7 vs. 2.8	Complications were same
Cohen et al.,	108 vs.	TAPP vs. TEP	1.9 vs. 0	Complications equal,

Author	Hernias *(n)*	Intervention	Recurrence Rate (%)	Salient Results
	100			TAPP easier
Lepere et al.,	1290 vs. 682	TAPP vs. TEP	1 vs. 1	Similar local complication and recurrence rates

IPOM, intraperitoneal onlay mesh repair; TAPP, transabdominal preperitoneal hernia repair; TEP, totally extraperitoneal repair.

Intraperitoneal Onlay Mesh Repair

Only a thin layer of peritoneum separates the abdominal cavity from the preperitoneal space. The rationale for the IPOM repair is to place a prosthesis directly onto the peritoneum so that radical preperitoneal dissection can be avoided. Initial laparoscopy, port placement, and landmark identification are the same as for the TAPP repair. A large prosthesis is introduced into the peritoneal cavity and secured in place with tacks, staples, or sutures. Some surgeons open the peritoneum over Cooper's ligament to ensure adequate fixation in this area.

This repair has been less popular than the TAPP and TEP approaches because of concern among surgeons about placing a prosthesis directly in contact with intraperitoneal structures. Many believe that it should be considered an

experimental operation. In addition, the results in several series have not been as good as the results of other laparoscopic repairs, with a higher incidence of neuralgia and recurrence, but this may be more a reflection of experience than the operation itself. The IPOM repair represents the only truly minimally invasive herniorrhaphy because radical dissection of the preperitoneal space is avoided. The development of a totally inert prosthesis might renew interest in the future.

COMPLICATIONS OF LAPAROSCOPIC INGUINAL HERNIA REPAIR

Complications of Laparoscopic Hernia Repair

Associated with Laparoscopy	**Associated with the Patient**	**Associated with the Hernia Repair**	**Associated with the Prosthesis**
Major vascular injury (I) Retroperitoneal Intra-abdominal Abdominal wall Bowel injury (I, E)	Ileus (E) Urinary retention (E) DVT (E) Cardiopulmo	Recurrence (D) Trocar site problems Hematoma (E) Infection	Contraction (D) Erosion (D) Folding (E) Infection

Associated with Laparoscopy	Associated with the Patient	Associated with the Hernia Repair	Associated with the Prosthesis
Bladder injury (I, E) Gas embolism (I) Bowel obstruction (E, D) Shoulder pain (E) Subcutaneous/preperitoneal emphysema (I, E) Diaphragmatic dysfunction (E) Arrhythmias (I)	nary complications (I, E)	(E) Hernia (D) Keloid (D) Seroma(E) Hematoma (I, E) Groin Scrotal Retroperitoneal Hydrocele (E,	(E, D) Rejection (D) Pain (E, D)

Associated with Laparoscopy	Associated with the Patient	Associated with the Hernia Repair	Associated with the Prosthesis
		D) Orchitis (E) Infertility (D) Neurologic (D) Groin pain Anesthesia Paresthesias Dysejaculation (D)	

D, delayed manifestation (weeks to years); DVT, deep venous thrombosis; E, early manifestation (hours to days); I, immediate/intraoperative manifestation.

Complications Associated with the Laparoscopic Approach

Major Vascular Injury

The risk of major vascular injury requiring operative repair is 0.08%.Many authors believe that this incidence is seriously underestimated because such injuries commonly go unreported. Entry in to the peritoneal cavity is the most important phase of laparoscopy, and over three quarters of major vascular injuries occur during entry of the Veress needle or the trocars at the beginning of the procedure. The vessels most frequently involved include the aorta, inferior vena cava, and the iliac artery and vein. Mesenteric and omental vessels, splenic vessels, and renal vessels have been injured occasionally. Epigastric vessels running in the rectus sheath may be injured during the placement of secondary trocars. The use of disposable trocars with safety shields, optical trocars, and blunt-tipped cannulas has not eliminated this dramatic complication. It has even been described during the open approach with the Hasson cannula used for initial access.

Knowledge of the anatomic relationships between the anterior abdominal wall and the retroperitoneum, careful introduction of the Veress needle, and

avoidance of the Trendelenburg position during initial access have been reported to decrease the incidence of this complication. Major vascular injury is manifested as either hemoperitoneum or retroperitoneal hematoma. Mortality has been estimated to be as high as 36%. Expeditious laparotomy with repair of the vessel is usually required. Lacerations of the epigastric vessels can be controlled by applying pressure applied with a cannula. Occasionally, suture ligation is required, which is now possible with the use of an "exit device" for transfascial suture placement.

Bowel Injury

The incidence of bowel injury and bowel perforation in laparoscopic operations is about 0.13%. Up to half of these injuries occur during the entry stage of laparoscopy. The small bowel is the most commonly segment (56%). About two thirds of these injuries are detected intraoperatively. The injury can be repaired laparoscopically if the operator is trained in intracorporeal suturing or the injury is amenable to a stapled repair without compromising luminal diameter. Patients with missed bowel injury typically manifest peritoneal signs and sepsis 1 day to 1 week after the index operation. The overall mortality rate with this complication is about 4%.

Bladder Injury

Injury to the bladder may occur from suprapubic trocar placement or from dissection during the course of the operation. Bladder injury may be obvious when blood and gas collect in the drainage bag if a Foley catheter is in place. When there is any doubt about bladder injury, methylene blue dye may be instilled into the bladder to look for leakage. Bladder injury recognized can be operated either laparoscopically or by open approach according to surgeons preference, followed by bladder drainage for 7 to 10 days. Bladder injury may be manifested in delayed fashion as hematuria and lower abdominal discomfort. A retrograde cystogram generally confirms the diagnosis. Small defects may be managed with urinary drainage, whereas larger defects necessitate repair.

Gas Embolism

Gas embolism is avery rare and lifethreatening complication. Carbon dioxide can be introduced into a large vein, most likely the result of inadvertant cannulation by the Veress needle, and trapped in the right ventricle, where it causes outflow obstruction into the pulmonary artery and sudden circulatory collapse. Careful insertion of the Veress needle and the usual confirmatory tests of its intraperitoneal position should keep the incidence of air embolism low.

Intestinal Obstruction

During the developmental years of laparoscopic inguinal hernia repair the importance of closing all fascial defects greater then 5 mm was not recognized. This resulted in the development of Richter's hernia with bowel obstruction in occasional patients. Several devices that can be used to close fascial defects larger than 5 mm are now routinely available commercially. Inadequate peritoneal closure over the prosthesis after the TAPP repair may leave gaps that allow bowel to migrate into the preperitoneal space and thereby result in bowel obstruction. Operative strategies to minimize this complication have been described in the section on operative techniques. With the advent of the TEP repair it was hoped that bowel-related complications would be minimized or eliminated. However, frequently unrecognized peritoneal defects are common after the TEP repair, especially in patients with previous lower abdominal surgery, and intestinal obstruction has been reported.Delayed adhesive small bowel obstruction is theoretically possible because of the intra-abdominal dissection. Fortunately, this complication is exceedingly rare.

Shoulder Pain

Shoulder pain is commonly seen after any laparoscopic procedure and can be quite troublesome to the patient. It is commonly assumed that retained carbon dioxide in the abdominal cavity is trapped under the diaphragm and causes diaphragmatic

irritation and pain to the shoulder as referred pain, but this has never been proved. Nevertheless, it is standard practice to completely deflate the pneumoperitoneum at the conclusion of laparoscopic inguinal herniorrhaphy with the patient still in the Trendelenburg position. A low-pressure pneumoperitoneum has also been recomended.

Subcutaneous and Preperitoneal Emphysema

Subcutaneous emphysema is usually harmless and resolves spontaneously, aided by massaging anterior abdominal wall swelling toward the nearest entry of trocar site. Preperitoneal emphysema is due to a malpositioned Veress needle and can be frustrating to the surgeon. It can be avoided by using a Hasson cannula for primary access.

Diaphragmatic Dysfunction

Diaphragmatic dysfunction has been described after a variety of laparoscopic procedures. Its exact etiology is unclear, but the effects are transient and generally resolve spontaneously by 24 hours.

Cardiac Arrhythmia

Bradycardia may occasionally follow the creation of pneumoperitoneum. It is a vagal response in reflex to peritoneal distention. It can usually be managed by

stopping the inflow of carbon dioxide temporarily and administering an anticholinergic drug. Once the heart rate has recovered, pneumoperitoneum can be re-created gradually.

COMPLICATIONS ASSOCIATED WITH THE PATIENT

Ileus

Ileus is somewhat more common after a laparoscopic inguinal hernia repair than after a conventional repair. It is a self-limited problem but occasionally requires nasogastric decompression.

Urinary Retention

Older age, general anesthesia, aggressive hydration, narcotics for pain relief, and a history of prostatic symptoms predispose to urinary retention after hernia repair. Intermittent catheterization or temporary placement of an indwelling urinary catheter is usually adequate therapy. Prophylactic use of prazosin after herniorrhaphy may significantly reduce the incidence of urinary retention and catheterization.

Deep Venous Thrombosis

The incidence of deep venous thrombosis after laparoscopic procedures is about 0.33%. Thromboprophylaxis for laparoscopy is same like other surgeries for 7 to 10 days. Graduated compression stockings, sequential intermittent compression devices, maintenance of relatively low insufflation pressure, keeping use of the reverse Trendelenburg position to a minimum, and intermittent release of the pneumoperitoneum in longer procedures are other measures that can decrease the incidence of deep venous thrombosis.

COMPLICATIONS ASSOCIATED WITH HERNIA REPAIR

Recurrence

The often-quoted rate of recurrence after a laparoscopic repair is on the order of 3%. Similar recurrence rates are also routinely seen after the open tension-free repair. Most of these data are from specialty centers, however, and the overall recurrence rate after laparoscopic herniorrhaphy may be closer to 10%.

Hernia recurrences may be difficult to distinguish clinically from lipoma of the cord, a seroma, or a bulge in the internal oblique muscle and may require imaging with ultrasound, CT, or MRI. Definitive identification of recurrence is especially important to avoid unnecessary surgery in those with groin pain. It is logical to

approach the recurrence through a previously undissected plane, and thus many surgeons prefer to perform an open anterior tension-free repair for a hernia previously repaired laparoscopically. Laparoscopic preperitoneal herniorrhaphy after a previous failed endoscopic herniorrhaphy is controversial. A strong argument can be made that this procedure should not be performed except in cases in which failure has occurred in both the conventional and the preperitoneal space. Nevertheless, surgeons are confronted with patients who request a laparoscopic repair regardless. This situation most commonly comes up when the patient has previously undergone conventional repair on the opposite side. In the hands of experienced laparoscopists, this would appear to be an acceptable approach. However, it is a technically demanding procedure with the potential for serious complications for the uninitiated, most notably bladder injury. Therefore, referral to a specialty center by the practicing surgeon should be considered in such cases. The TAPP procedure is the safest laparoscopic herniorrhaphy for these recurrent hernias inasmuch as a significant series using the TEP approach has not been reported.

Infertility

Injury to the vas deferens or the testes can cause infertility. The incidence of injury to the vas deferens during inguinal hernia repair is 0.3% in adults and up to 2% in

children. The vas deferens may be injured in suturing or manipulating cord. Traction injuries to muscular wall of the vas deferens sustained during mobilization may interfere with transfer of spermatozoa. Unilateral injury to the cord can lead to exposure of spermatozoa to the immune system and the formation of antisperm antibodies, thus causing infertility.

Ischemic Orchitis

Interruption of blood flow to the testis because of inguinal herniorrhaphy may result in ischemic orchitis and subsequent testicular atrophy. It is manifested 1 to 3 days after surgery as a painful, enlarged, firm testicle accompanied by low-grade fever. Its incidence in large series of TAPP repairs was 0.11%. Complete excision of all indirect inguinal hernia sacs is thought to be an important cause secondary to trauma to the testicular blood supply, especially the delicate venous plexuses. Large indirect inguinal-scrotal hernia sacs should be divided just distal to the internal ring. The proximal portion of the sac is ligated and the distal part is opened on its anterior surface as long as possible.In contrast to urologist stand this do not lead to hydrocele postoperatively. Treatment is largely supportive and consists of elevation and anti-inflammatory medication.

Groin Pain

Chronic groin pain is a major cause of morbidity after inguinal hernia surgery. Its incidence may be as high as 53% at 1 year of follow-up. Evaluation of postherniorrhaphy groin pain involves ruling out a myriad of causes, including muscle injury, adductor strain, osteitis pubis, and lumbosacral disorders. The superior soft tissue resolution offered by MRI makes it the most useful diagnostic modality for evaluation of postherniorrhaphy groin pain. The etiology of this groin pain can be

Nociceptive—as a result of direct tissue damage

Somatic

Visceral

Neuropathic—as a result of nerve damage.

Nociceptive pain is further subdivided into (1) somatic, which is the most common and includes ongoing preoperative pathology that was the real cause of the patient's pain, usually related to injury to the ligament or muscle, and (2) visceral pain, which is pain related to a specific visceral function and includes urinary problems and the dysejaculation syndrome. Neuropathic pain is caused by damage to nerves or incorporation by staples or suture material during the repair. The nerves that

may commonly be involved are the genital and femoral branches of the genitofemoral nerve and the lateral femoral cutaneous nerve. Treatment of all three types of pain is initially conservative and consists of reassurance, anti-inflammatory medications, cryotherapy, physical therapy, and local nerve blocks, except when sudden severe groin pain is present immediately after surgery, which suggests a stapled or sutured nerve. Such a patient can benefit from immediate reexploration. Otherwise, groin exploration should be reserved as a last resort because the results are often less than satisfactory. Our approach when groin exploration is the only option is to perform a combined laparoscopic and conventional groin exploration with fluoroscopic capability to maximize the chance of removing as much mesh and as many fastening devices as possible. Neurectomy, neuroma excision, and adhesiolysis are performed if indicated. The hernia is then repaired in the conventional space.

Wound Infection

Wound infection rates of up to 3% have been described with the laparoscopic approach, but this problem is fortunately quite rare. Although antibiotic prophylaxis is quite commonly used for inguinal herniorrhaphy, its role in preventing infection is not clear.

MATERIALS AND METHODS

This study consisted of 50 patients who were operated for inguinal hernia laparoscopically (TAPP,TEP) whose complications were documented both intraoperatively and postoperatively in our hospital from 2013 to 2014.

Inclusion criteria:

1.Patients who were diagnosed as having inguinal hernias (unilateral,bilateral,recurrent hernias)

2. Patients who were eligible for giving written valid consent (>18yrs)

Exclusion criteria:

1.Patients who require emergency exploration (strangulated hernias, obstructed)

2. Other hernias like femoral,ventral wall hernias

3.Patients who were not willing to follow up

METHODOLOGY

1.Patients who were admitted in our hospital with inguinal hernia from 2013 to2014

2.A detailed history taking and clinical examinations were done

3.Thorough preoperative evaluation were done including cardiac evaluation and ultrasonogram of abdomen.

4.Explained about the laparoscopic procedure and its complications with written consent

5. All the patients were subjected for appropriate surgery (49 patients were subjected to TEP,one patient TEP was converted to TAPP)

6.Adequate post op care given including NPO till anesthetic effects weaned off, parentral antibiotics(thirdgeneration cephalosporins)

7. Patients were discharged once free of complications usually on third postoperative day.(POSTOP COMPLICATIONS WERE DOCUMENTED)

8. Advised to come for stitch removal .

9. All the patients were kept on follow up for a minimum period of 6 months.

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OBSERVATION AND RESULTS

This observational study was done in patients admitted in department Of general surgery , Stanley medical college,Chennai who were diagnosed as Having inguinal hernias during 2013 to 2014.

Total no of cases - 50

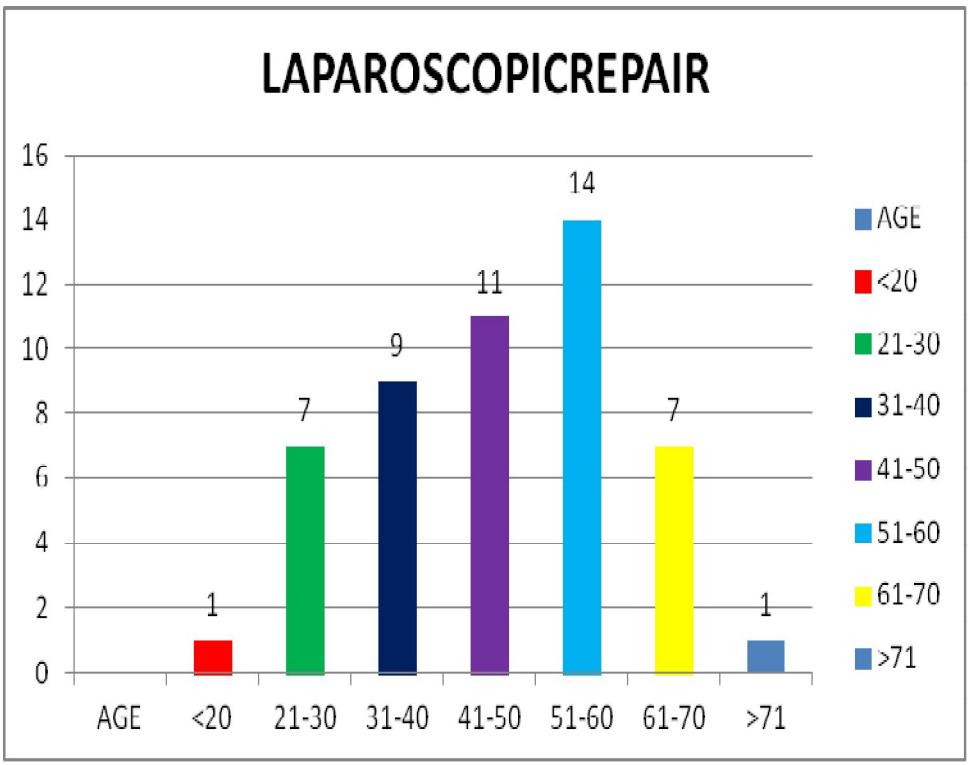
No of laparoscopic repair

TEP - 49

TAPP - 1

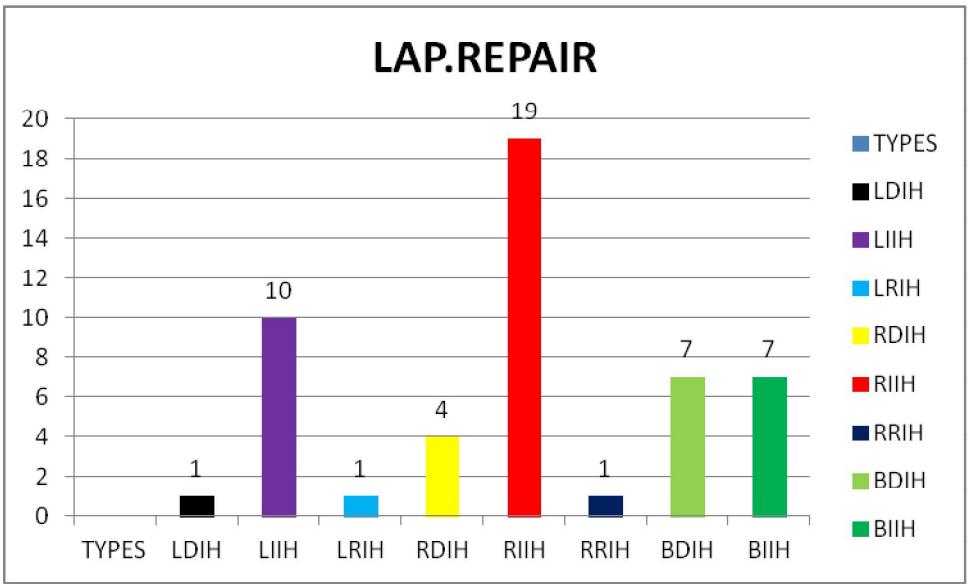
All cases underwent thorough physical examination, preoperative evaluation ,routine investigations and subjected to surgery .their complications were meticulously recorded.

AGE DISTRIBUTION



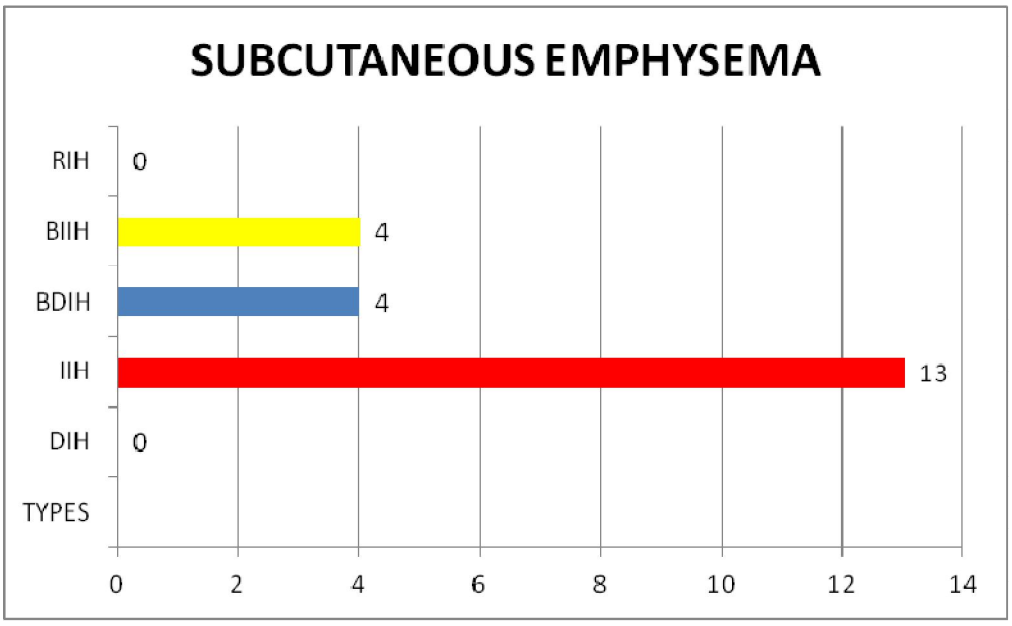
- In our study patients were aged between 20 – 75 years were subjected to laparoscopic repair.

TYPES OF INGUINAL HERNIA



TYPE OF HERNIA	NO.OF PATIENTS	%
LDIH	1	2%
LIIH	10	20%
LRIH	1	2%
RDIH	4	8%
RIIH	19	38%
RRIH	1	2%
BDIH	7	14%
BIIH	7	14%

C0MPLICATIONS OF LAPAROSCOPIC REPAIR



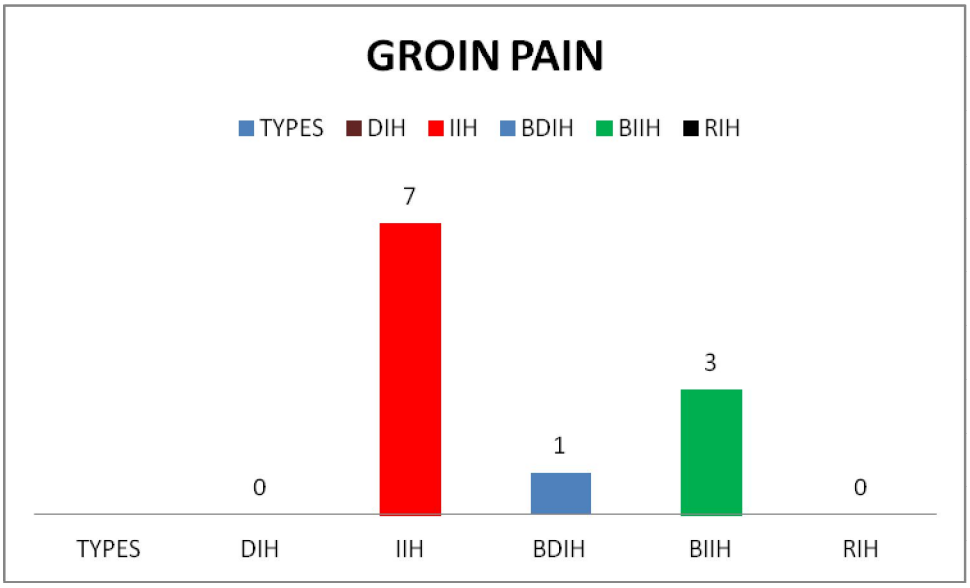
TYPE OF HERNIA	N0 OF PATIENTS WITH S.EMPHYSEMA	%
IIH	13	26%
DIH	0	0
RIH	0	0
BIIH	4	8%
BDIH	4	8%

TYPE OF HERNIA Vs SURGICAL EMPHYSEMA

TYPE OF HERNIA	SUR.EMPHYSEMA	TOTAL PATIENTS	%
IIH	13	29	44.82%
DIH	0	5	0
RIH	0	2	0
BIIH	4	7	57.14%
BDIH	4	7	57.14%

In our study out of 50patients 21 patients developed surgical emphysema.

In indirect inguinal hernia patients out of 29 patients 13 patients developed surgical emphysema,in bilateral hernia out of 7 patients 4of them developed surgicalemphysema.



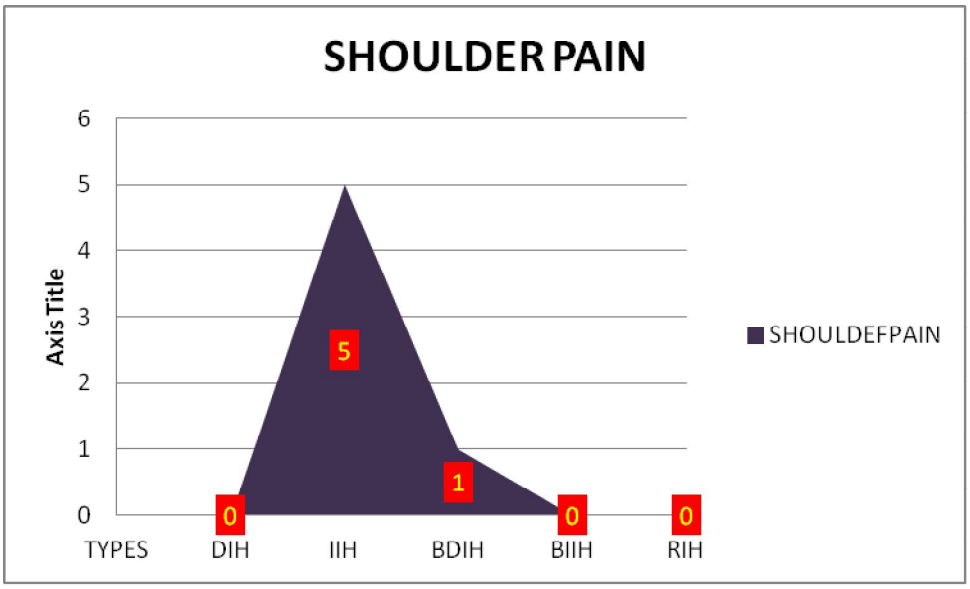
TYPE OF HERNIA	NO OF PATIENTS	%
DIH	0	0
IIH	7	14%
BDIH	1	2%
BIIH	3	6%
RIH	0	0

GROIN PAIN Vs TYPE OF HERNIA

TYPE OF HERNIA	PATIENTS WITH GROINPAIN	TOTAL PATIENTS	%
DIH	0	5	0
IIH	7	29	24.1
BDIH	1	7	14.2
BIIH	3	7	42.8
RIH	0	2	0

In our study, 13 patients developed groin pain.

In indirect inguinal hernia patients out of 29 patients 7(24.1%) developed groin pain, none of the direct hernia, recurrent hernia patients developed groin pain, bilateral direct hernia patients out of 7 patients 1 developed groinpain(14.2%).In bilateral indirect hernia patients out of 7 patients 3(42.8%)of them developed groin pain.



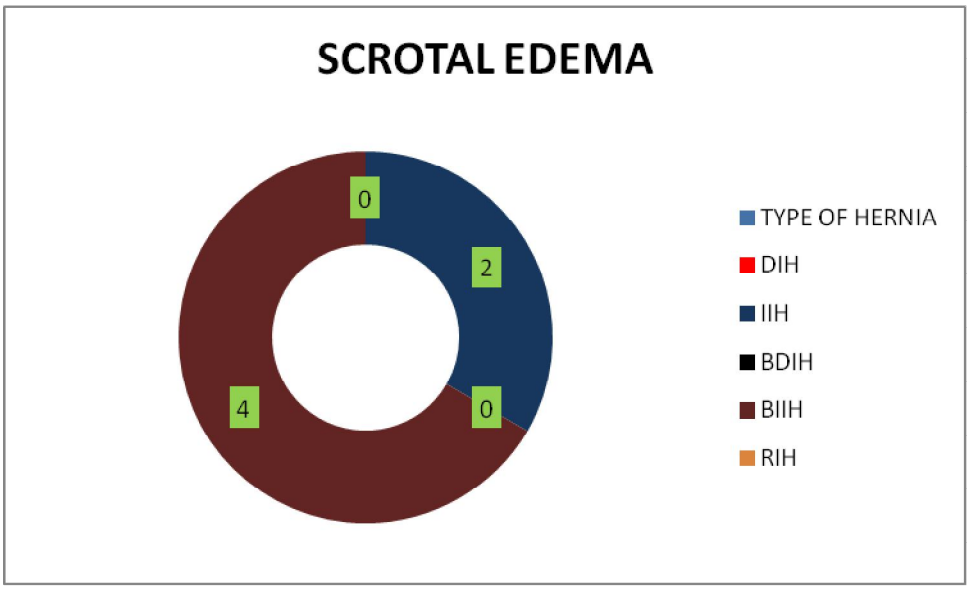
TYPE OF HERNIA	PATIENTS WITH SHOULDER PAIN	%
DIH	0	0
IIH	5	10%
BDIH	1	2%
BIIH	0	0
RIH	0	0

SHOULDER PAIN Vs TYPE OF HERNIA

TYPE OF HERNIA	PATIENTS WITH SHOULDERPAIN	NO.OF PATIENTS	%
DIH	0	5	0
IIH	5	29	17.2%
BDH	1	7	14.2%
BIIH	0	7	0
RIH	0	2	0

In our study out of 50 patients 6 of them developed shoulder pain.

In indirect inguinal hernia, out of 29 patients 5 (17.2%) of them developed shoulder pain. Out of 7 patients 1 patient developed shoulder pain in bilateral direct hernia. None of the direct hernia, bilateral indirect hernia and recurrent hernia patients developed this complication.



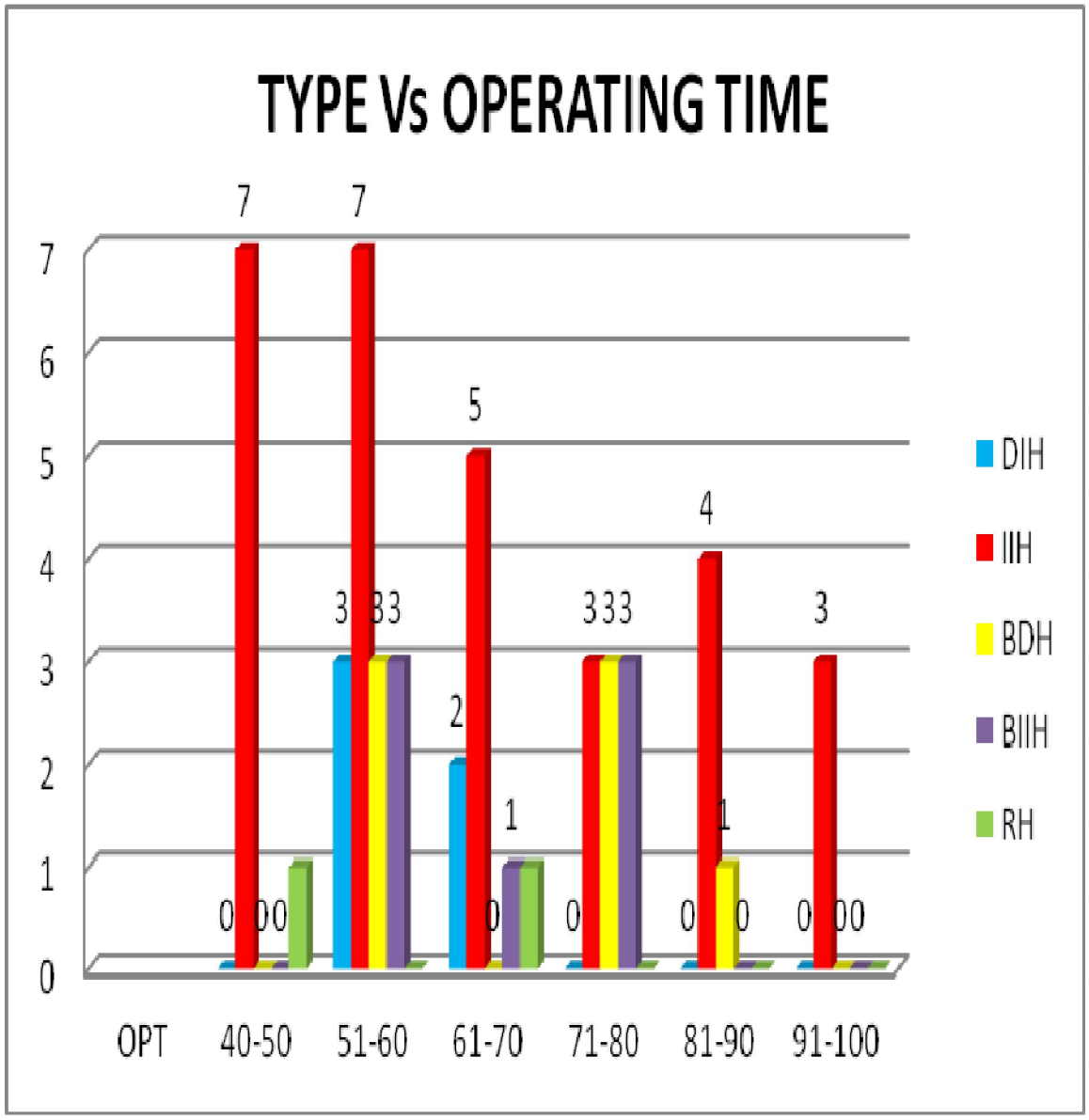
TYPE OF HERNIA	PATIENTS WITH SCROTAL EDEMA	%
DIH	0	0
IIH	2	4%
BDIH	0	0
BIIH	4	8%
RIH	0	0

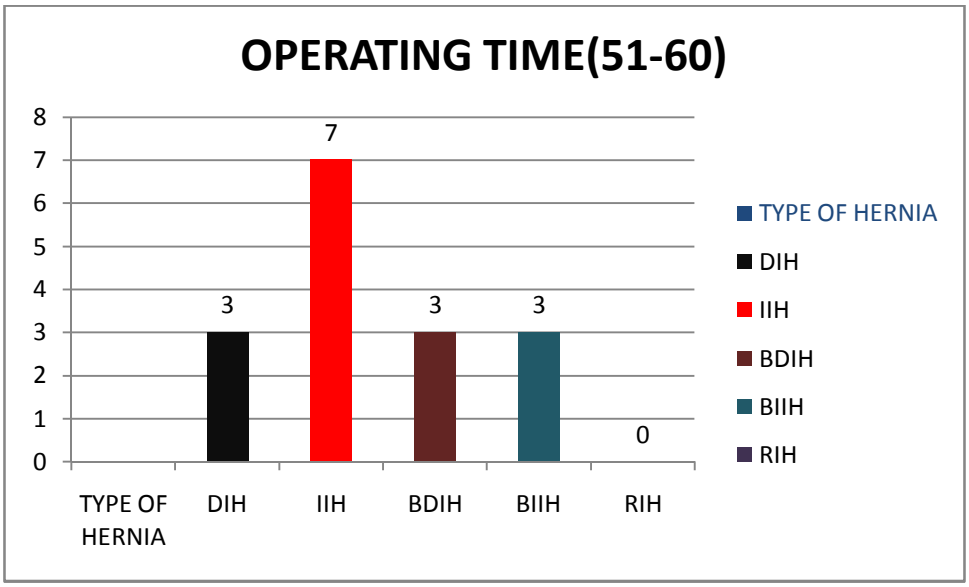
TYPE OF HERNIA Vs SCROTAL EDEMA

TYPE OF HERNIA	PATIENTS WITH SCROTAL EDEMA	NO OF PATIENTS	%
DIH	0	5	0
IIH	2	29	6.9%
BDH	0	7	0
BIIH	4	7	57.14%
RIH	0	2	0

In our study out of 50 patients 6 of them developed scrotal edema.

In indirect inguinal hernia patients 2 of them developed scrotal edema out of 29, in bilateral indirect inguinal hernia patients out of 7 patients 4 of them developed scrotal edema. none of the u/l ,b/l direct hernia patients or recurrent hernia patients developed this complication.


TYPE Vs OPERATING TIME
7
6
5
4
3
2
1
0
7
7
5
4
3
3
3
3
3
2
1
1
0
0
0
0
0
0
0
0
0
0
OPT
40-50
51-60
61-70
71-80
81-90
91-100
DIH
IIH
BDH
BIIH
RH



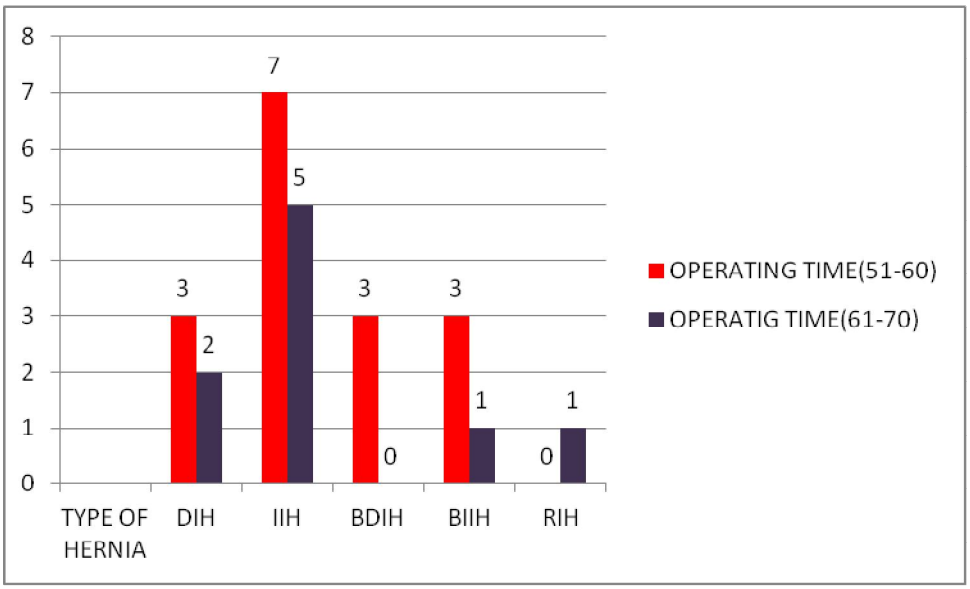
TYPE OF HERNIA	NO OF PATIENTS OPERATED IN 40-50M	%(OUT OF 50 PATIENTS)
DIH	0	0
IIH	7	14%
BDIH	0	0
BIIH	0	0
RIH	1	2%

TYPE OF HERNIA	PATIENTS OPERATED	NO OF PATIENTS	%
DIH	0	5	0
IIH	7	29	24.13%
BDH	0	7	0
BIIH	0	7	0
RIH	1	2	50%

In our study out of 50 patients 8 patients of indirect inguinal hernia were operated within 40-50 minutes.

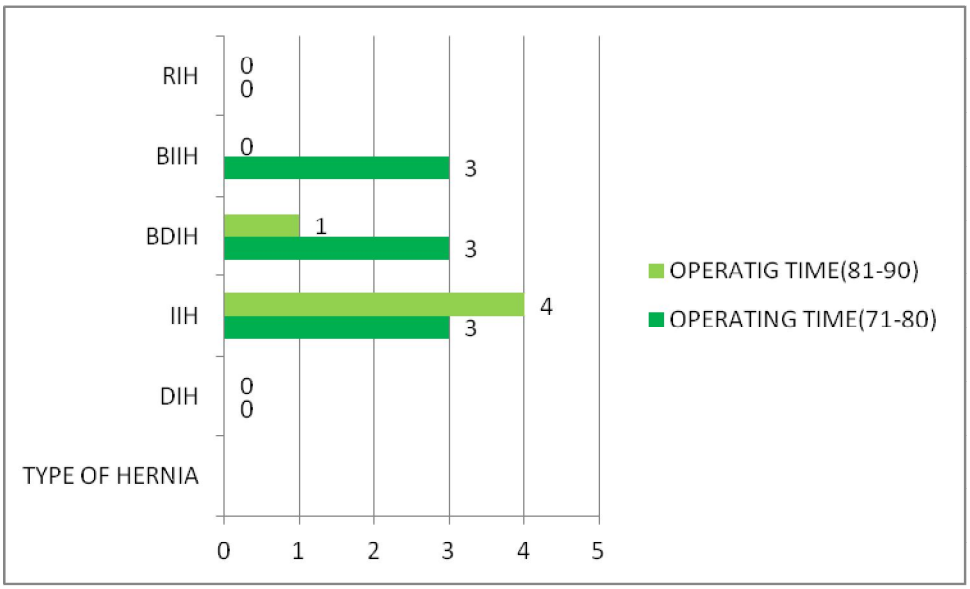
Out of 29 patients,7 (24.13%) of them were operated for indirect inguinal hernia(u/l).

Out of 2 patients, 1 patient was operated for recurrent inguinal hernia within 40-50 minutes.



TYPE OF HERNIA	OPT-51-60MTS		OPT 61-70 MTS	
	NO OF PATIENTS	%	NO OF PATIENTS	%
DIH	3	6%	2	4%
IIH	7	14%	5	10%
BDH	3	6%	0	0
BIIH	3	6%	1	2%
RIH	0	0	1	2%

Out of 50 patients 16 patients were operated within51to 60 minutes,9patients were operated within 61 to 70 minutes.



TYPE OF HERNIA	OPT 71-80 MINUTES		OPT 81-90 MINUTES	
	NO OF PATIENTS	%	NO OF PATIENTS	%
DIH	0	0%	0	0%
IIH	3	6%	4	8%
BDH	3	6%	1	2%
BIIH	3	6%	0	0%
RIH	0	0%	0	0%

Out of 50 patients 9 of them were operated within 71-80 minutes and 5 patients were operated within 81-90 minutes.

TYPE OF HERNIA	OPT 91-100 MINUTES NO OF PATIENTS	%
DIH	0	0
IIH	3	6%
BDH	0	0
BIIH	0	0
RIH	0	0

Out of 50 patients 3 of them were operated with in 91-100 minutes.

DISCUSSION

Since the invention of laparoscopic repair for inguinal hernia, it had underwent numerous modifications. Despite the developments long learning curve and lack of documentation regarding fearful complications in laparoscopy made laparoscopic inguinal hernia repair a difficult task for surgeons.

Later, numerous trials were carried out in laparoscopic hernia repair regarding open technique Vs laparoscopy and came out with laparoscopy as superior technique.

The laparoscopic hernia repair are of two types namely total extra peritoneal repair (TEP) and trans abdominal pre peritoneal repair (TAPP),both these techniques evolved over a period of last two decades with TEP overtaking TAPP as entry into abdomen is avoided thereby preventing fearsome intraabdominal complications like visceral injury, bowel and bladder injury. still the other complications with TEP remain as a darker side for laparoscopic surgeons as there was lack of trials and statistical data

As this is a era of trials, this following study will pave the way for understanding those complications both intraoperative and post operative period and prevent them.

This was a observational study (prospective and retrospective) consisting of 50 patients who underwent laparoscopic inguinal hernia repair (TEP and TAPP) in department of general surgery, Stanley medical college, Chennai during 2013 to 2014,which included a minimum 6 months follow up.

The following factors were taken into account,

1. Type of hernia
2. Type of hernia Vs complications
3. Operation time.
4. Operation time Vs complications.
5. Postoperative hospital stay.

GENDER DISTRIBUTION

All the patients in our study were males.

Confirms the lower incidence of inguinal hernia in females.

AGE DISTRIBUTION

In our study age distribution were more even, cases were between 20 to 75years.

TYPE OF HERNIA

Out of 50 patients 5(10%) were direct hernia, 19(38%) were indirect hernia,14(28%) were bilateral hernia patients and 2(4%) were recurrent hernia patients.

OPERATION TIME Vs TYPE OF HERNIA

OPT 40-50MINUTES:

Out of 50 patients 8 of them(7-unilateral indirect hernia,1recurrent hernia) so 16% of patients were operated in span of 40 to 50 minutes.

OPT 51-60 MINUTES:

In this time period 16 of them were operated(7-u/l indirect,3-direct,6 bilateral) 32% of them were operated,here there is even distribution of patients in all types ofinguinal hernia.

OPT 61-70MINUTES:

Here 9 (18%) were operated 5 of them belong to indirect type.

OPT 71-80 MINUTES:

Here 6(12%) were bilateral 3 were u/l indirect and none were direct long duration owing to time taken for dissection in bilateral and u/l indirect type hence none of the direct hernia came into this category.

OPT 81-90 MINUTES:

In this time period mostof them 4(8%) were indirect this is also due to the time taken for dissection and most of these patients were operated duringthe initial phase of learning curve because remaining 3(6%) also belonged to u/l indirect type .

LAPAROSCOPIC REPAIR	MEAN DURATION
INGUINAL HERNIAS	66.8 MINUTES

STUDY	DURATION IN TEP	DURATION IN TAPP
LEE L.SWANSTORMET AL	57 MINUTES	92 MINUTES
YASSER HAMAZA ET AL	96.2 MINUTES	77.4 MINUTES

So, In our study mean duration is comparable to other studies. Indirect hernia took longer time comparing direct due to the time taken for dissection of sac and surgeons learning curve is also important in deciding the operation time in laparoscopic repair.

COMPLICATIONS

COMPLICATIONS	LAP.REPAIR IN OUR STUDY
MAJOR	0
MINOR	23(46%)

STUDY	COMPLICATION RATE
YASSAR HAMAZA ET AL	8%
FELIX ET AL	9%
COHEN ET AL	13.5%

There were NO MAJOR complications.There were 4 minor complications developed in 23 patients. Those complications in our study were,

1. Surgical emphysema 2 . Early transient groin pain 3. Right shoulder pain. 4. Scrotal edema.

SURGICAL EMPHYSEMA:

Out of 50 patients 21 of them developed subcutaneous emphysema.

13 of them were indirect type and 8 of them were belonged to bilateral hernia.

This appears to be mainly due to the dissection in indirect hernia and also due to the operation time because none of the u/l direct hernia developed this complication. All cases of surgical emphysema regressed by 2nd postoperative day without surgical intervention.

EARLY TRANSIENT GROIN PAIN:

Out of 50 patients 11 of them developed groinpain, among 11 ,10(7 u/l indirect 1-b/l indirect) of them were indirect hernia. Early transient groin pain developed only in indirect hernia patients owing to the dissection of indirect sac hence none of the direct (except 1 b/l direct) hernia developed this complication.

This complication subsided with analgesics within the first postoperative week.

SHOULDER PAIN:

Out of 50 patients 6(12%) developed this complication,5(10%) were indirect hernia, but none of the b/l hernia or direct hernia developed this complication, so this complication occurred in unilateral indirect hernia not due to dissection but due to the long duration of surgery during initial phase especially >90minutes because indirect hernia which was operated later with shorter duration do not had this complication (probably due to retention of CO2 ,leads to diaphragmatic irritation hence referred pain to shoulder occurred) Shoulder pain subsided on 2nd post operative day.

So, shoulder pain is directly proportional to the duration of surgery.

SCROTAL EDEMA:

Out of 50 patients 6 (12%) developed this complication,only indirect hernia patients suffered this complication. None of the direct hernia patients developed this complication, this was mainly due to the dissection carried out for indirect sac.

So,longer the dissection due to adhesions patients more prone to develop this complication. Scrotal edema subsided on 3rd postop day without any intervention.

POSTOPERATIVE STAY:

STUDY	POSTOP STAY
YASSAR HAMAZA ET AL	1
PALANIVELU ET AL	1

LAPAROSCOPIC REPAIR	MEAN POST OP STAY IN DAYS
INGUINAL HERNIAS	2.6 DAYS

All our patients discharged within 3 days without any further surgical intervention.

SUMMARY

The aim of this study is to understand and prevent the complications of laparoscopic inguinal hernia repair. It consists of 50 patients who underwent laparoscopic hernia repair in our institution. The observations in our study are follows:

- ✓ Overall 50 patients were operated-5 u/l direct,29 u/l indirect, 7 b/l direct and 7b/l indirect.
- ✓ All were operated under general anesthesia.
- ✓ The mean operative time was 66.8 minutes
- ✓ There was no major complications
- ✓ Minor complications rate were 46% (23 patients)
- ✓ There was 4 minor complications namely, 1.surgical emphysema 2.groin pain, 3.shoulder pain, 4.scrotal edema
- ✓ Surgical emphysema(21patients,42%) depends upon operation time
- ✓ Groin pain(11 patients-22% all are indirect) depends upon type of hernia mainly in indirect type, because of the dissection carried out for seperating indirect sac.

- ✓ Shoulder pain (6 patients-12%) is directly proportional to the time of surgery (all were >90 minutes)probably due to retention of CO2 which lead to diaphragmatic intervention.
- ✓ Scrotal edema(6 patients-12%) depends upon the type of hernia as it occurred only in indirect hernias due to the dissection for indirect sac
- ✓ All these minor complications were subsided with supportive care without any surgical intervention.
- ✓ Mean operation time in our study is 66.8 minutes.
- ✓ Mean Post operative hospital stay- 2.6 days.
- ✓ Laparoscopic hernia repair has a steep learning curve and time consuming in its initial phase but in later stage it can be done with shorter duration without any complications and with early postoperative recovery.
- ✓ Laparoscopic inguinal hernia repair also has the advantage of identifying contralateral and occult hernias

CONCLUSION

Laparoscopic hernia repair has a steep learning curve and fearsome complications but once mastered , it is the safest and efficacious technique with reduced operative time and early postoperative recovery. .In our study (TEP) we encountered only minor complications all those complications were managed conservatively. Though the mean operative time was comparable to other studies , it was mainly due to the laparoscopic learning curve the minor complications were initially higher than others but later it was reduced.

Overall, laparoscopic inguinal hernia repair is the safest and efficacious technique once it is mastered and also large sample of randomized controlled trials were necessary inorder to document other complications so that in future lot of patients can be saved from morbidity and mortality.

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PROFORMA

Name:	Unit:	IP No:
Sex: Male / Female	Age :	Address:
Socio-economic status:	Occupation:	Religion:
DOO:	DOA:	DOD:

COMPLAINTS:

1. Swelling
2. Pain in Swelling / Groin
3. Others

HISTORY OF PRESENTING ILLNESS:

1. Swelling:

   i.) Duration

   ii) Site and size

   iii) Rate of progress

   iv) Reducibility: Spontaneous / Manual. Not reducible

2. Pain in Swelling : Absent / Present

   Duration / Nature / Relation to appearance of swelling

3. Others: Abdominal Colic / Vomitting / Abdominal Distention / Constipation / Irreducibility / Fever.

4. History of Straining Factors : Chronic Cough / Chronic Constipation / straining at micturition.

i) Reducibility : partial / Complete / Gurgling felt during reduction / Not reducible.

ii) Invagination test

iii) Internal ring occlusion test.

PERCUSSION : Dull / Tympanic

AUSCULTATION : Bowel sounds heard / not heard

EXAMINATION OF EXTERNAL GENITALIA:

1. Position of Penis
2. Phimosis / Meatal Stenosis / Stricture
3. Testis / Epididymis / Spermatic cord.

PER RECTAL EXAMINATION :

EXAMINATION OF OTHER SYSTEMS:

1. Abdominal Examination

   (Tone of Abdominal Wall / Malgaigne's bulges)
2. Respiratory system
3. Cardio-vascular system

INVESTIGATIONS:

1. Urine : Albumin / Sugar / Microscopy
2. Blood : Hb% / TC / DC / ESR
3. Blood : Sugar / Urea / Creatinine
4. Cardiac evaluation: ECG / (2D ECHO if required)
5. Screening Chest: Chest X –ray / (PFT if required)

TREATMENT:

Operation: Date of operation : ---------- Laparoscopic / Conversion

Type of hernia found : Left / Right / Bilateral Indirect / Direct / Femoral / Other

Type of repair : TEP / TAPP Time: Incision to Closure of camera port incision

Mesh size : ----------

Suture materials:----------

Ports : Size / Site : ----------.

PAST HISTORY:

1. Previous surgery i) For Hernia a) Same side b) Opposite side

ii) Other abdominal Surgery (Particularly Appendicectomy by extended Grid iron incision)

2. History of any associated medical conditions : Diabetes / Hypertension / Pulmonary Tuberculosis

PERSONAL HISTORY:

1. Nature of work: Sedentary / Moderate / Heavy
2. Smoking

GENERAL PHYSICAL EXAMINATION:

1. Build and Nutrition: Good / Moderate / Poor
2. Anaemia / Cyanosis / Jaundice / Clubbing / Dependent Oedema / Lymphadenopathy
3. Vital signs : Temperature / Pulse / Respiration / BP

LOCAL EXAMINATION:

(Patient in standing and recumbent position)

INSPECTION:

1. Swelling:
   - Unilateral / Bilateral
   - Position and Extent
   - Size and shape
   - Spontaneous visible peristalsis
2. Skin over swelling
3. Expansile impulse on cough
4. Spontaneous reducibility in recumbent position.

PALPATION:

1. Swelling : Position and Extent

   Warmth / Tenderness

   Consistency : Doughy and Granular / Elastic / Tense

   Other procedure :---------- Scrub Nurse : ----------

SURGEON : ---------- Camera assistant: ----------

Second assistant : ----------

Anesthesia type (General Anesthesia /Regional Anesthesia): ----------

Blood loss : ---------- ml Operation time : --------Minutes

Pneumoperitoneum – No. of passes : ----------

Adhesions / None / Few / Many / Major problems

Instruments :

Stapler : No / Yes Type : ----------Drain : No / Yes

Clips ---------used; Sutures ---------- type and number; Peritoneum closure : Clips/ Sutures

INFORMED CONSENT

Name: Age/ Sex: IP:

I herewith declare that I have been explained in a language fully understood by me regarding the purpose of this study, methodology, proposed intervention, plausible side effects, if any and sequelae.

I have been given an opportunity to discuss my doubts and I have received the appropriate explanation.

I understand that my participation in this study is completely voluntary and that I am free to withdraw from this study at anytime without any prior notice &/ or without having my medical or legal rights affected.

I permit the author and the research team full access to all my records at any point, even if I have withdrawn from the study. However my identity will not be revealed to any third party or publication.

I herewith permit the author and the research team to use the results and conclusions arising from this study for any academic purpose, including but not limited to dissertation/ thesis or publication or presentation in any level.

Therefore, in my full conscience, I give consent to be included in the study and to undergo any investigation or any intervention therein.

Patient's Sign

Investigator's Sign

சுய ஒப்புதல் படிவம்

ஆராய்ச்சி நிலையம் : அரசு ஸ்டான்லி மருத்துவமனை
சென்னை - 600 001

ஆராய்ச்சி தலைப்பு : **நுண்துளை அறுவை சிகிச்சையின் பின் பிளைவுகள் நோய் குடல் இறக்கம்**

பங்கு பெறுபவரின் பெயர் :

வயது :

விலாசம் :

எனக்கு குடல் இறக்கம் ஏற்பட்டுள்ளதை மருத்துவர் மூலம் அறிந்தேன். அதற்கு நுண்துளை அறுவை சிகிச்சையின் அவசியத்தையும் அறிந்தேன். இதனால் ஏற்படும் பின் விளைவுகளை மருத்துவ ஆய்வுக்கு பயன்படுத்தப்படும் என்பதையும் அறிவேன்.

இந்த விளைவுகளை ஆய்வு ஏடுகளில் பதிவு பெறும் என்பதையும், இதற்காக காசோலை வழங்கப்படமாட்டாது என்பதையும் அறிந்து இந்த ஆய்விற்கு முழு மனதுடன் சம்மதிக்கிறேன்.

நோயாளியின் கையொப்பம்/
இடது பெருவிரல் பதிவு :

இடம் :

தேதி :

S	NAME	IP.NO	AGE	S	DIAG	PROCEDU	OPT	MAJ	MINOI	POH	RECURREN	S.EMPHYSEMA	GROINPAIN	SHOULDERPA	SCROTALEDEM
1	RAJALINGAM	8382	60	M	RIIH	TEP	100m	NIL	PRESENT	3D	NIL	PRESENT	PRESENT	PRESENT	PRESENT
2	JAIGANESH	11955	31	M	LIIH	TEP	90m	NIL	PRESENT	3D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
3	ARUNKUMAR	13791	25	M	RIIH	TEP	65m	NIL	ABSENT	4D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
4	DILLIBABU	21878	28	M	RIIH	TEP	85m	NIL	PRESENT	2D	NIL	PRESENT	PRESENT	ABSENT	ABSENT
5	ARUMUGASAMY	37322	52	M	RIIH	TEP	90m	NIL	PRESENT	4D	NIL	PRESENT	PRESENT	PRESENT	ABSENT
6	LINGARAJ	1401028	20	M	RIIH	TEP	65m	NIL	ABSENT	3D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
7	SELVARAJ	17553	51	M	LIIH	TAP	95m	NIL	PRESENT	2D	NIL	PRESENT	PRESENT	PRESENT	PRESENT
8	VINCENT	8418	50	M	LIIH	TEP	95m	NIL	PRESENT	3D	NIL	PRESENT	PRESENT	PRESENT	ABSENT
9	JEGATHEESAN	8447	60	M	LDIH	TEP	65m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
10	RAJA	11683	51	M	RIIH	TEP	90m	NIL	PRESENT	2D	NIL	PRESENT	PRESENT	PRESENT	ABSENT
11	ARULRAJ	13273	57	M	RDIH	TEP	65m	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
12	MOH.KANI	16004	63	M	BLDIH	TEP	90m	NIL	PRESENT	3D	NIL	PRESENT	PRESENT	PRESENT	ABSENT
13	KASI	115780	75	M	BLDIH	TEP	80m	NIL	PRESENT	3D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
14	MOHAN	18938	34	M	LIIH	TEP	60m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
15	DHAMODHARAN	18260	50	M	LIIH	TEP	75m	NIL	PRESENT	2D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
16	VENKATESAN	18855	34	M	RIIH	TEP	75m	NIL	PRESENT	2D	NIL	PRESENT	PRESENT	ABSENT	ABSENT
17	NEMAKUMAR	18854	33	M	RIIH	TEP	75m	NIL	ABSENT	2D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
18	ELUMALAI	18861	49	M	BLIIH	TEP	80m	NIL	PRESENT	2D	NIL	PRESENT	PRESENT	ABSENT	PRESENT
19	VINAYAGAM	20527	35	M	BLIIH	TEP	80m	NIL	PRESENT	3D	NIL	PRESENT	PRESENT	ABSENT	ABSENT
20	MAHESH	1421693	25	M	LIIH	TEP	65m	NIL	ABSENT	3D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
21	BABU	23039	30	M	LIIH	TEP	60m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
22	VELU	1423034	35	M	RIIH	TEP	70m	NIL	ABSENT	2D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
23	SATHYASEELAN	23047	44	M	RIIH	TEP	60m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
24	JAYARAMAN	21793	65	M	RDIH	TEP	60m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
25	ANANDHAN	23088	60	M	BLDIH	TEP	75m	NIL	PRESENT	3D	NIL	PRESENT	ABSENT	ABSENT	ABSENT

26	SHEIK	1423123	55	M	RDIH	TEP	55M	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
27	JESUDOSS	23138	60	M	BLDIH	TEP	75m	NIL	PRESENT	3D	NIL	PRESENT	ABSENT	ABSENT	ABSENT
28	KALIAPPAN	18862	64	M	BLIIH	TEP	75m	NIL	PRESENT	3D	NIL	PRESENT	ABSENT	ABSENT	PRESENT
29	SUDHAKAR	24772	36	M	RIIH	TEP	60m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
30	DURAI	23528	49	M	BLDIH	TEP	60m	NIL	PRESENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
31	DHANASEKHAR	26212	22	M	RIIH	TEP	55M	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
32	RAMESH	26536	45	M	BLIIH	TEP	60m	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
33	MAYAKANNAN	27985	50	M	RDIH	TEP	60m	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
34	USMAN	29495	27	M	LIIH	TEP	65m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
35	MUNUSAMY	29529	42	M	RIIH	TEP	60m	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
36	SHANKAR	39972	35	M	RIIH	TEP	55M	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
37	JAYAPAL	28446	52	M	LRIH	TEP	70m	NIL	PRESENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
38	AJEESH	32463	62	M	LIIH	TEP	50M	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
39	SIVASANKAR	32549	48	M	BLIIH	TEP	60m	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	PRESENT
40	SUBRAMANI	31006	45	M	BLIIH	TEP	60m	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	PRESENT
41	REYASUDDIN	32618	55	M	RIIH	TEP	50M	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
42	SURESH	33102	45	M	BLIIH	TEP	70m	NIL	PRESENT	3D	NIL	PRESENT	PRESENT	ABSENT	ABSENT
43	ANBALAGAN	32525	56	M	RIIH	TEP	50M	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
44	SHAKER	1435563	39	M	RIIH	TEP	45M	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
45	GOVINDSAMY	1437086	70	M	BLDIH	TEP	55M	NIL	PRESENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
46	MOHAMMAD	1437094	61	M	LIIH	TEP	45M	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
47	KANNIYAPPAN	1437040	52	M	RRIIH	TEP	45M	NIL	ABSENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
48	PARTHASARATHY	1439967	63	M	BLDIH	TEP	60m	NIL	PRESENT	3D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
49	VEDHA	1441826	55	M	RIIH	TEP	45M	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT
50	VIGNESH	1444285	23	M	RIIH	TEP	45M	NIL	ABSENT	2D	NIL	ABSENT	ABSENT	ABSENT	ABSENT